RIG

Remote Imaging Group
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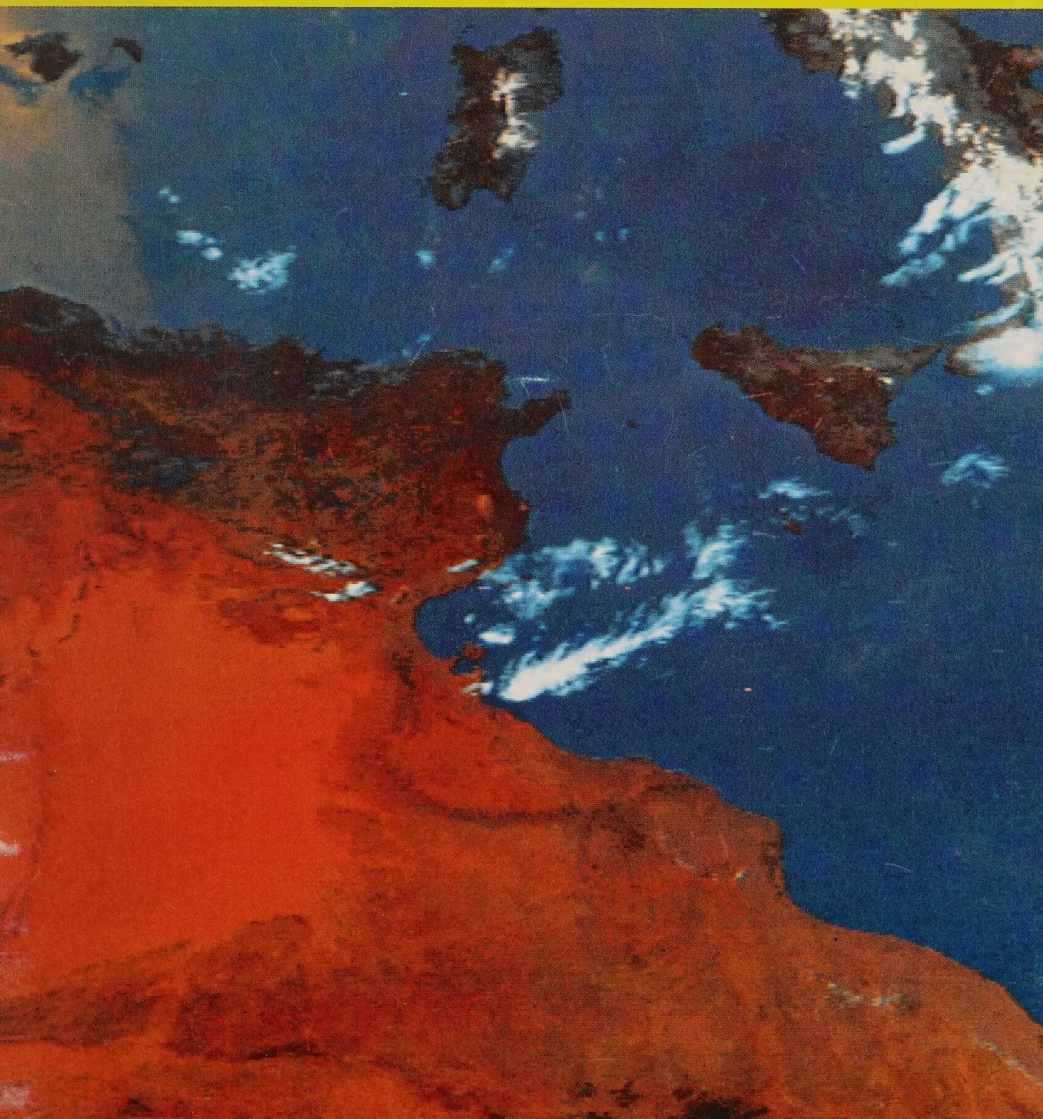

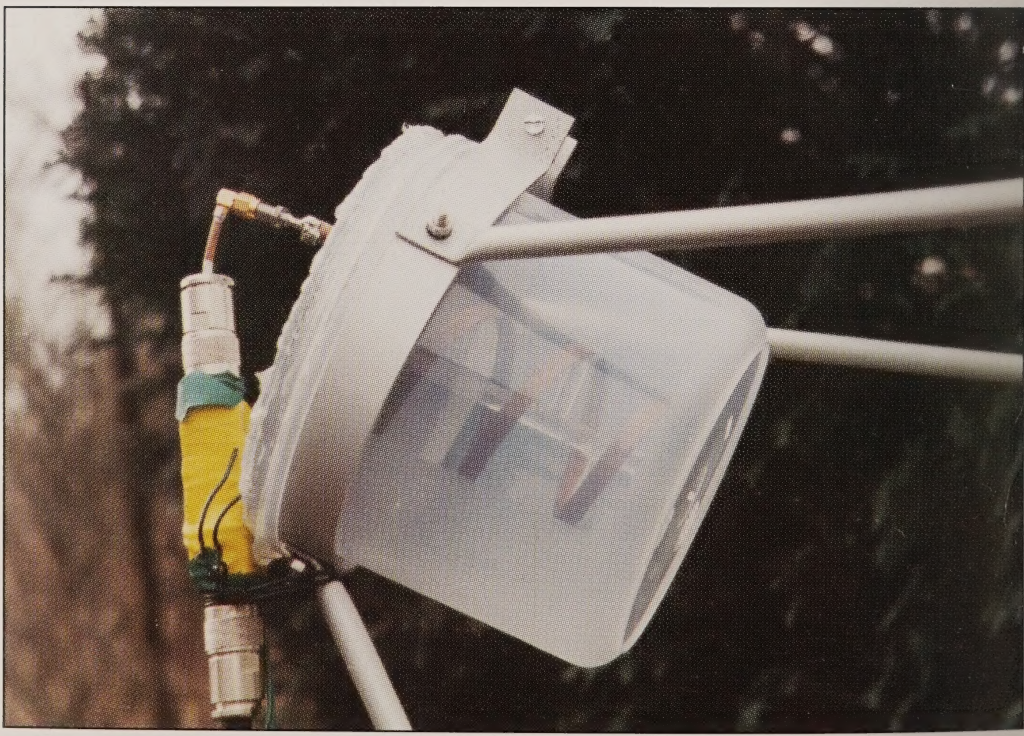

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Centre pages: Predictions courtesy Simon Goodall

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FROM THE EDITOR'S DESK

PETER WAKELIN

It is difficult to believe it is still only February, and early February at that. The crocuses have come and gone and the daffodils are just opening. I picked fresh rhubarb from the garden in January and judging from the avian antics in the berberis bushes the sparrow population will soon be on the increase. Even the bees are busy on the heather flowers. Winters like this used to be exceptional but there have been several in the last ten years almost as mild as this one. The unusually warm weather has not been confined to southern England either; much of northern and western Europe and the eastern USA and Canada have experienced record-breaking warm winter temperatures too. There still appears to be little or no ice in the Gulf of Bothnia.

Just what effect man's activities are having on the global climate is still unclear. Although an overall rise in mean temperature seems inevitable, just how this change translates into changes in weather patterns is less certain. The effects of natural phenomena such as the recent huge volcanic eruptions and large variations in sea surface temperature in the tropical Pacific are difficult to separate from man-made ones. Mathematical modelling of global climate has made great strides in recent years, as has the prediction of shorter term changes but there is still a long way to go. Just a few months ago the abnormally high sea temperatures in the eastern Pacific were predicted to have peaked, yet recent radar observations from the Upper Atmosphere Research Satellite (UARS) indicate further thermal expansion of the sea water since then indicating still higher temperatures (see "On the Track of El Niño" in this issue). More satellites, more observations, greater computing power and lots more money are all needed to get at the answers.

Once again, this issue includes quite a wide range of topics which, hopefully, will cater for all tastes. Ray Godden, our membership secretary has passed to me all the comments made on the renewal forms which were included in the last issue. These were much appreciated and I will incorporate some of the suggestions in futue issues of the journal.

RIG could be on Internet in the near future as we have been offered a World Wide Web page at no cost to the Group. If any members familiar with WWW have any ideas on how the page could best be used and what they would like to see on it then please let me know by e-mail (peter@ascotrig.demon.co.uk), or any other means. ⊕

RIG CONFERENCE AND AGM, GUILDFORD,
Saturday 29 April 1995

The response of members to the notice about the conference and AGM has been very positive. At the time of writing, 7 February, registrations are up to 118. People are coming from all parts of the UK and several from Europe. There is an upper limit of 230 to the number that can be accommodated so if you wish to come you are strongly advised to register as early as possible. To register, write to Mr FJ Bell, Coturnix House, Rake Lane, Milford, Godalming, Surrey, GU8 5AB. The registration fee is £10, which includes lunch and free parking for the first 80 cars. Please make cheques payable to FJ Bell and include a sae. All those who register will receive a location map, local B&B accommodation details and a programme in good time for the conference.

The Exhibition

The response from potential exhibitors has been very good and I am hoping that all main firms RIG members deal with will be present to demonstrate their latest products. RIG will have its own stand for demonstrations and where orders can be placed for equipment. It is hoped that RIG will have, for direct sale, CD-ROMs from Eumetsat; software may also be available.

The Lectures and Demonstrations

The details of these are still being formulated but it is hoped to have a programme which will be of interest to beginners and experienced remote imagers alike. If you wish to make a presentation or offer a special demonstration let me know. Members who would like to demonstrate any special techniques or facilities they use, are welcome to bring their own equipment. This could be a valuable source of information for other members and a special workshop area will be provided for this facility. Please let FJ Bell know if you are bringing your own equipment. There will be a demonstration of sending images by Slow Scan TV.

VIP Guests

Some VIP guests have been invited. The Space Minister the Rt. Hon. Ian Taylor, MBE, MP has said he would like to come but this must be subject to other political priorities he may have. Helen Sharman has also been invited.

The AGM

The AGM is timed for 4.15 pm on Saturday 29th April 1995 at the same venue as the conference. All members, whether attending the conference or not, have a

right to attend the AGM. The agenda for the AGM is as follows:-

1) Minutes of 1994 AGM.
2) Matters arising therefrom.
3) Chairman's report.
4) Treasurer's report.
5) Secretary's report.
6) Membership Secretary's report.
7) Journal and Make-up Editors' reports.
8) Encryption Matters.
9) Nominees for 1995 Committee.
10) Election of Committee.
11) AOB. General discussion with topics from the floor, subject to time.

Your present Committee:

Henry Neale	Les Currington	Mark Clarke
John Tellick	Ray Godden	Peter Wakelin
Mark Pepper	Michael Gill	Frank Bell
Co-opted member:	Sheila Newcombe	

Any nominations for the committee should be with the Secretary by 29 March 1995.

A quarterly publication for hardware, software and applications of WEFAX, APT, VAS, HRPT and GOESTAP.

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RENEWALS 95 - COMMENTS

Ray Godden G4GCE

This is a regular feature at this time of the year based on the comments that members have made on the survey form. At the time of writing (19th January) 1170 renewals have been received - this looks promising for maintaining or increasing our membership for 1995. At the end of last year membership was 1947, so we did not quite make 2K!

Around 400 of you made comments. Most of them were enthusiastic and congratulatory: "RIG = wonderful." "Each issue a gold mine of information." "An excellent, cost effective, Journal and organisation." "RIG Journal is more and more interesting and beautiful, issue after issue." Many find the present coverage and balance of the Journal very acceptable: "I think that the Journal is a very good read in its present form." "Fine magazine, please continue." "A well produced and balanced Journal to a very high standard for the cost - some difference to the newsletters from ——!" "RIG is probably the best of all the group journals to which I subscribe." "Enjoyed the colour images and the articles on the basics of image interpretation, Regularly make use of Keplers, timetables and satellite updates." "This is my first year as a member of RIG and I have found the Journal a very important source of information both for technical topics and equipment."

Not all comments were so favourable. There were some (very few) criticisms. The question - 'RIG no longer sells equipment at rallies. Will this cause you any difficulties?' - raised one person's ire: "What an appallingly biased last question on this survey. (Almost worthy of a politician!) All questions should be of the yes/no format, i.e. 'Do you wish RIG to sell equipment at rallies?' Were you frightened of the probable result?" Well I leave it to the reader to decide which is the most appropriate wording and whether the question, as put, takes a binary response. Others were concerned that RIG will no longer show and demonstrate equipment at rallies: "How do the uninitiated get the feel of things? How can I view working systems to choose which is best for me?" In fact RIG will continue to attend rallies and demonstrate at them.

One member felt that: "Constructional articles are often poorly written and researched as far as performance goes ... a simple statement of 'good performance' is not good enough." Some were concerned that we had become too esoteric: "Definitely no longer attractive to the 'newcomer'." "Less than 3% of members receive HRPT. Whilst I agree they make very impressive images for the front and back covers, it seems to snub the predominantly APT and geostationary majority." "I am possibly one of the few members who is not a 'Radio Ham'. I struggle at times to understand all that is said in the Journal".

This brings us to the needs of beginners, who made many suggestions to help them get to grips with this hobby: "Having joined recently I was very impressed with the Journal. However I found most topics beyond my understanding. Maybe a few beginners' items, or a reference page of topics and the back issues in which they may be found." "Some basic articles on using computers, type to use, interfacing, how to start." "An 'idiots' guide' to setting up polar and Meteosat systems." "Basic image formation, reception and processing." "Still very good but more help needed. Particularly choosing equipment." Overall the impression I have is that novices are more satisfied than in previous years, although more help and guidance is still needed. It should be mentioned here that several beginners expressed thanks for the help they had received from local members. It is very gratifying to know that RIG members are very willing to assist those who are just starting.

The other specific topic which was often mentioned was that of home construction: "It would be nice to see more constructional articles." "Keep up the home-brew articles as this is an important part of the hobby - if you build it yourself you probably get a better understanding of how it works." "Keep the practical articles where possible. Don't become another 'black-box' review magazine." "Home-brew and more home-brew." "It would be helpful if PCBs were available, or at least a black-and-white print-out of the design."

One popular interest is other remote imaging platforms: "Keep up the move towards other remote sensing missions. I am particularly interested in Landsat for example, EOS etc.", " .. the possibility of recovering data from certain space craft, i.e. the Hubble, Venus probe etc." Another topic was Internet: "Please publish Internet addresses." "I receive many more images via the Internet and WWW - it is getting to the point that material for teaching is now more available over the Net than live. Maybe you should address this issue."

Many other suggestions for Journal content and RIG activities were made - so many that a selection here cannot give more than their flavour: "If RIG could supply a cheap HRPT and PDUS receiver it would be very useful! (I'm never satisfied!)." "How about a Fax-back service for Kepler elements?" " Would it be possible to publish a list of satellites with their frequencies", "... really technical articles on satellite design? Or 'on Earth' testing pre-launch?" "A reference manual on CD-ROM annually, with pictures etc." "Have we done an article on what gear the Met Office uses?" "It would be nice to have an article on accessing the RIG BBS and the best type of modem to use". "The only minor irritation which I find in this excellent publication is that some of the mouth-watering pictures have no caption."

Overall your reaction has been highly favourable. Your appreciation compensates

for all the hard work that goes into sustaining 'RIG'. The Journal is particularly well- regarded and all who have contributed should be encouraged. I hope this review will stimulate some of you to fill some of the needs expressed here by writing suitable articles. RIG is undoubtedly in good shape for 1995. We are not however complacent and, with your help, will do our best to continue the progress of 'RIG' in the future.

Finally, a footnote to show how determined RIG members can be in pursuing this hobby: "Here is my new address. As my neighbours did not like my 1.6 metre HRPT/PDUS dish I had to move somewhere else." ⊕

MEMBERSHIP SECRETARY'S REPORT FOR 1994 - CORRECTIONS

Ray Godden G4GCE

I have discovered some errors in the report published in RIG 39. These were in the categories of viewing method and types of computer. Here are the correct numbers with the changed values underlined.

Viewing method:

Computer	906 (684)	Frame store	<u>209</u> (261)

Types of computer:

IBM compatible	796 (566)	Archimedes	<u>49</u> (58)	BBC	<u>51</u> (59)
Amiga	<u>44</u> (52)	Atari	<u>17</u> (21)	Mac	<u>6</u> (7)

How it happened I do not know - computers never make mistakes, do they! The incorrect numbers were all too low, exaggerating the fall off in the use of frame stores and the use of computers other than IBM compatibles. ⊕

MEMBERS' ADVERTISEMENTS

Members may advertise surplus equipment etc. for sale in the Journal free of charge but subject to space being available. Advertisements should be concise and must be for goods relevant to RIG activities. They should be submitted to the Journal editor and not the Advertising Manager.

FOR SALE. Maplin receiver-decoder-framestore. Perfect working order (Maplin checked), Maplin cases and panels. Good starter kit. £200 ono. Delivery paid. Phone John, G3KEC, 01752 812904.

THE INTERNET - PART 1

Tom Larkin

In this series of articles I hope to educate the average computer user about the world of computer communications and how radical and fast that world has changed in the last 20 years. In this first part, I look at the Internet from a historical point of view. Later I describe how one gets into the net itself and then finally, I look at some useful and not so useful items of information and where to get them.

The Internet was born about 20 years ago, as a U.S. Defense Department network called the ARPAnet, the Advanced Research Projects Agency net. The ARPAnet was an experimental network designed to support military research; in particular, research on how to build networks that could withstand partial outages and still function. In the ARPAnet model, communication always occurs between a source and a destination computer. The network itself is assumed to be unreliable; any portion of the network could malfunction and disappear at any moment. It was designed to require the minimum of information from the computer clients. To send a message on the network, a computer only had to put its data in an envelope, called an Internet Protocol (IP) packet, and "address" the packets correctly. The communicating computers (not the network itself) were also given the responsibility to ensure that the communication was accomplished. The philosophy was that every computer on the network could talk, as a peer, with any other computer. This was the begining of peer-to-peer computer communication. At first as users experimented with various forms of networking, many kinds of data were transferred. To ensure efficient and, more importantly, error free transmissions, different packet sizes were developed and ultimately led to a standard protocol called the IP or Internet Protocol. It soon became clear that the only practical method for computers from different manufacturers to communicate was through using the IP protocol and used with a Transmisson Control Protocol the communications standard know today as TCP/IP was born.

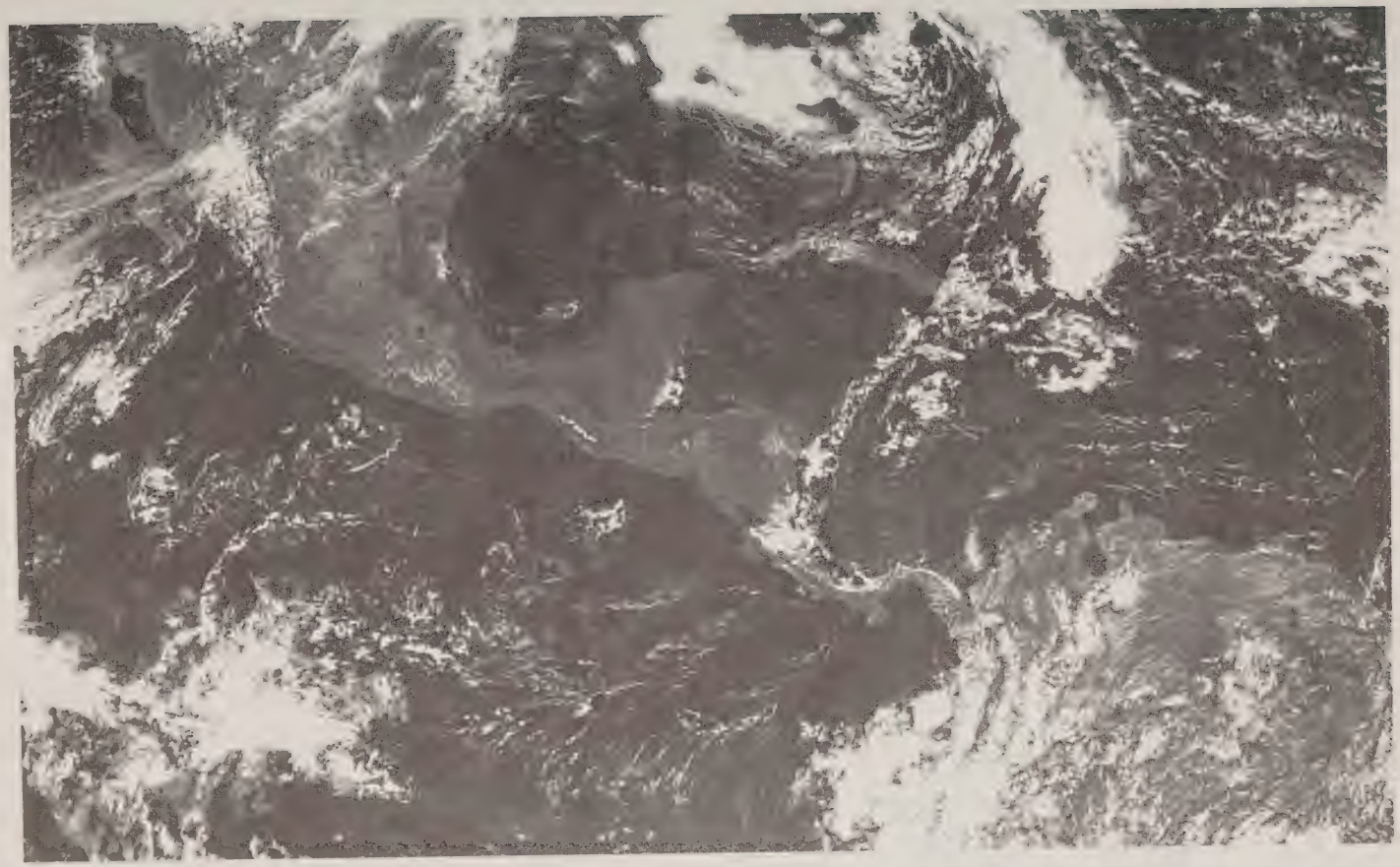
Because different computers could communicate, an interest developed very quickly by both governments and universities alike, which did not have policies saying that all computers must be bought from the same vendor. Everyone bought whichever computer they liked and expected the computers to work together over the network. About ten years later, Ethernet local area networks (LAN) and workstations came on the scene. Most of these workstations came with Berkeley UNIX, which included IP networking. This created a new demand; rather than connecting to a single large timesharing computer per site, organizations wanted to connect the ARPAnet to their entire local network. This would allow all the computers on that LAN to access ARPAnet facilities. At about the same time, other organizations started building their own networks using the same communications protocols as the ARPAnet; namely, IP and its relatives.

It became obvious that if these networks could talk together, users on one network could communicate with those on another and everyone would benefit. One of the most important of these newer networks was the NSFNET, run by the National Science Foundation (NSF), an agency of the U.S. government. In the late 80s the NSF created five supercomputer centres. Up to this point, the world's fastest computers had only been available to weapons developers and a few researchers from very large corporations. By creating supercomputer centres, the NSF was making these resources available for any scholarly research. Only five centres were created because they were so expensive and this meant that they had to be shared, which then created a communications problem; they needed a way to connect their centres together and to allow the clients of these centres to access them. At first, the NSF tried to use the ARPAnet for communications but this strategy failed because of bureaucracy and staffing problems.

In response, NSF decided to build its own network, based on the ARPAnet's IP technology. It connected the centres with 56,000 bit per second (56k bps) telephone lines. It was obvious, however, that if they tried to connect every university directly to a supercomputing centre, they would go broke. One line per campus with a supercomputing centre at the hub, like spokes of a bike wheel, adds up to lots of miles of phone line. Therefore, the NSF decided to create regional networks. In each area of the country, schools would be connected to their nearest neighbour. Each chain was connected to a supercomputer centre at one point and the centres were connected together. With this configuration, any computer could eventually communicate with any other by forwarding the conversation through its neighbours.

This solution was successful, and like any successful solution, a time came when it no longer worked. Sharing supercomputers also allowed the connected sites to share a lot of other things not related to the centres. Suddenly these schools had a world of data and collaborators at their fingertips. The network's traffic increased until, eventually, the computers controlling the network and the telephone lines connecting them were overloaded. In 1987, a contract to manage and upgrade the network was awarded to Merit Network Inc., which ran Michigan's educational network in partnership with IBM and MCI. The old network was replaced with faster telephone lines (by a factor of 20) and with faster computers to control it. The process of upgrading continues to this day. However, most of these changes aren't noticed by the people trying to use the Internet to do real work.

Perhaps even more important, the process of running out of capacity and improving the network has created a technology that's extremely mature and practical. The ideas have been tested; problems have appeared and problems have been solved. The most important aspect of the NSF's networking effort is that it allowed everyone to access the network. Up to that point, Internet access had been



Internet gives access to images from satellites which are below your horizon. This one was obtained from a NASA Internet site and shows Central America as seen by GOES 8 on 16 January.

available only to researchers in computer science, government employees and government contractors. The NSF promoted universal educational access by funding campus connections provided the campus planned widespread accessibility. Then everyone attending a four-year college could become an Internet user.

The growing strength of the NSFnet as it expanded to connect mid-level and statewide academic networks began to replace ARPAnet for research networking and in 1990, ARPAnet was dismantled. It did not matter that ARPAnet ceased operations, because all of the interconnections growing out of other networks easily replaced it.

The backbone of the current Internet network belongs to the National Science Foundation but is managed by Advanced Network and Services, Inc. (ANS) in a partnership among IBM Comp., MCI Communications Corp. and a consortium of universities in Michigan. Since 1989, commercial Internet access providers have been able to lease interchange points from ANS and offer electronic mail, file transfer and database services to individuals and corporations. In addition, the 35 regional networks connected to the Internet backbone are moving to become more independent of government funding by selling Internet connections. Compuserve, MCI Mail and GEnie are among commercial online services that offer electronic mail gateways to Internet and Sprint Communications Co. launched SprintLink as an access to Internet in 1992.

Today the demand keeps growing. Now that most four-year colleges are connected, people are trying to get secondary and primary schools connected. People who have graduated from college know what the Internet is good for and talk to their employers about connecting corporations. All this activity points to continued growth, networking problems to solve and evolving technologies.

In the next part I will be looking at various ways to connect to the internet and will introduce some of the tools that you would come across. 🌐

FOR SALE. Timestep 4.1 PROscan receiver for 137 MHz, PROsat II capture card, associated Timestep software, and RIG crossed dipoles with reflectors. Cost £317, offers to Michael Harrison, G3HKH, Weybridge 01932 847112.

FOR SALE. Philips high resolution b/w monitor £50. G0HFB (QTHR) 01503 (Looe) 282683.

WANTED. Please help me find the 18-inch rolls of metallic paper used on Siemens weatherfax machine. Don Bremer, KB6LO, Rt 4 Box 339, Joplin, Missouri 64804, USA.

NASA TWO-LINE ELEMENTS FOR BEGINNERS

Peter Wakelin

INTRODUCTION

Many new members, and some not so new ones, find the strings of numbers variously referred to as elements, elsets, Kepler elements, Keps and, on rare occasions, NASA two-line elements very daunting. Here is a brief, non-mathematical look at what each is and what it does.

The majority of these numbers are born in a computer underneath a mountain somewhere in Colorado, USA and are made available to us by NASA. Obviously those relating to classified objects are not available to everyone. Unfortunately, after leaving NASA, people add bits and cut bits out and the products found in some publications and on some bulletin boards are non-standard but it is usually not too difficult to identify what's what.

The two lines of characters (hence the name Two-Line Elements) are sufficent to identify the object, determine the shape and size of its orbit and its orientation in space at a specified time together with the position of the satellite in the orbit at that time. Other elements are included which indicate how the orbit is changing.

I will give an example of a recent two-line element set and describe each group of characters in turn.

```
1 23455U 94089A    95032.70958391  .00000024  00000-0   37393-4 0   536
2 23455  98.8880  336.3930 0008602 216.7664 143.2924  14.11487547 4693
```

LINE ONE

The consecutive lines are numbered 1 and 2 in the first character. The next two groups in the first line are the object Catalogue Number, 23455 and the International Designator. In this case the object is component A (which is usually the primary payload - NOAA 14) of the 89th successful launch in the year 1994. The U after the catalogue number indicates an unclassified object.

The next group of 14 characters is the Epoch, or the instant at which the elements are valid. It is expressed as the year followed by a three digit day number and then the decimal part of a day. In this case, the 32nd day of 1995 plus .70958391 day, which in our more usual system of timing, equates to about 48 seconds after 1701 on 1 February 1995. This is always expressed in Universal Time; none of that Colorado Standard Daylight-saving Tea-time nonsense here!

The next group is a very small number, usually positive, whose official description is "First Time Derivative of the Mean Motion". It expresses the rate at which Mean Motion (see below) is changing and is often referred to as Half N-Dot, Acceleration or Drag.

I'll skip to the end of line one now passing over three terms which, for the sake of completeness, are the Second Time Derivative of Mean Motion, B-Star Drag Term and Ephemeris Type. They are often edited out anyway. The last character in line 1, and in line 2, is a Modulo 10 Checksum digit to enable you to check for possible transmission errors. Add all the digits in the line except the last one, ignoring letters, spaces and decimal points but add one for each minus sign. Divide by 10 and the remainder should equal the checksum digit. In this case, the first line total excluding the final digit is 154. Add 2 for the two minus signs and subtract 150 to get a checksum digit of 6. So there was no transmission error. Could there have been two errors cancelling each other out? Don't loose too much sleep over it. As I said before, these things tend to get man-mutilated so the checksum rarely works anyway.

The four places prior to the last character in line 1 are allocated to the Element Set Number. Here it's the 53rd set issued.

LINE TWO

Line two starts with the identification as in the line above. Inclination comes next and is the angle between the plane of the orbit and the equatorial plane of the Earth. A zero inclination satellite is orbiting eastwards along the equator and if the inclination is greater than 90 degrees, as in this case, it is orbiting westwards. The next group is called the Right Ascension (RA) of the Ascending Node. The ascending node of the orbit is the point where it crosses the equator from south to north and its Right Ascension can be regarded as the celestial equivalent of longitude on Earth. These two terms, RA and inclination determine the orientation of the orbital plane in space.

The next group is the Eccentricity of the elliptical orbit which, by definition, must be less than unity so the leading decimal point is omitted. An eccentricity of .0008602 is small so the orbit is very nearly circular. The points in the orbit nearest to, and farthest from the Earth's centre are called the perigee and apogee respectively.

Eccentricity is followed by Argument of Perigee, a strange name for what is nothing more than the angular measurement around the orbit of the position of perigee from the northbound equator crossing point, or ascending node. In this example 216 degrees is rather more than halfway around the orbit so the satellite's closest approach to Earth occurs in the southern hemisphere. The next element also has

an odd name, Mean Anomaly. It is another angular measurement, this time measured around the orbit from perigee to where the satellite would be at the epoch time if it moved with uniform motion. This may seem unnecessarily complicated but there are good reasons for it but as most of the satellites we are interested in are in very nearly circular orbits their motion is almost uniform anyway. In our example, another 143 degrees beyond the perigee point just about brings us back to the ascending node again. This is no coincidence. It happens because the epoch of the elements is often computed to occur when the satellite is at the ascending node.

The final important number is Mean Motion. Our satellite makes 14.11487547 orbits of the Earth in 24 hours. That sounds like a straightforward statement but it needs a few words of explanation as orbits are not measured from equator crossing times. They are measured from the time the satellite passes through perigee, its closest point to Earth. Unfortunately, the perigee can move several degrees around the orbit in a day so dividing 24 hours by 14.11487547 will not give the interval between successive equator crossings. Returning to the acceleration term in the first line, the .00000024 doubled and added to the mean motion will give the approximate mean motion 24 hours later. It is an indication of how the orbit is slowly contracting under the influence of the extremely rarefied atmosphere that exists at satellite heights.

Mean Motion is quoted to 8 decimal places and is followed by up to 5 digits indicating the revolution number. In our example NOAA 14 has made 469 orbits of the Earth.

I hope that has clarified rather than confused matters. In the third paragraph I mentioned shape and size of the orbit but not once have I mentioned miles or kilometres so where does size appear in the elements? That is where the Kepler connection comes in and I shall take a deeper look into the relationships between the various elements in a future issue. Meanwhile, play around with a ping-pong ball and a loop of wire as a learning aid or better still, try a cherry and a pineapple ring on top of a generous mound of vanilla ice-cream. ⊕

METEOSAT ENCRYPTION

The encryption issue is still confusing some members. Only the high resolution digital images are to be encrypted. Members receiving, or planning to receive, the low resolution WEFAX data will not be affected this year or in the forseeable future. ⊕

INTERPRETING WEATHER SATELLITE IMAGERY - PART 10

Peter Wakelin

So far, in this series, I have made no mention of the "water vapour images" received from Meteosat. In response to requests from several members I shall attempt to take some of the mystery out of these images. They are usually intriguing, and some of them from the primary data channel in particular, are almost beautiful but what do they mean?

Firstly, we must go back to basics. As its name implies a radiometer measures radiation and those on weather satellites can be divided into two basic types. Firstly there are the imagers, which we are all familiar with, and there are also sounders. The more conventional "pictures" we see from the polar-orbiting satellites and the visible and thermal infrared ones from Meteosat are obtained from imagers at wavelengths for which there is little absorbtion by the atmosphere. Clearly there would be little point in trying to detect radiation from the ground or the top of a cloud at a particular wavelength if radiation at that wavelength could not get out of the atmosphere and reach the sensors on the spacecraft. Sounding radiometers work on a different principle and utilise wavelengths at which most of the radiation has been emitted by the constituent gases of the atmosphere itself.

Every molecule above zero degrees on the absolute temperature scale is radiating electromagnetic energy and different substances have different radiative characteristics. Most of the constituent gases of the atmosphere are of known, constant concentration, so if, for example, the radiometer is "tuned" to the wavelength where carbon dioxide, or oxygen emits strongly, then variations observed by the radiometer can be related to variations in temperature. Where a constituent gas like water vapour varies in its concentration throughout the atmosphere, then the radiometer readings can be used to build up a profile of that concentration.

The NOAA polar-orbiters carry the High-resolution Infra Red Sounder (HIRS) instrument and data from it are transmitted in the "beacon" signal on 136.77 or 137.77 MHz as well as in the HRPT data stream. This instrument is capable of obtaining useful temperature profiles, though they are rather crude compared with the very much more expensive radiosonde measurements. The horizontal resolution of these sounders is generally quite low, typically around 20km, but Meteosat was the first to utilise the 6.3 micrometre wavelength sounder (which senses radiation emitted almost entirely by water vapour) on a geostationary satellite and create a "picture" with a resolution equal to that of the more familiar infrared image.

The variations in grey levels in these images can be interpreted as approximating to the mean humidity in the upper troposphere, but with some limitations. The troposphere is the part of the atmosphere which contains most of our weather and

is bounded on the upper surface by the tropopause, above which lies the stratosphere where the air is dry and cloud-free. The height of the tropopause is generally around 10km in polar regions but rises to near 20km at the equator. The highest radiances, and the highest humidities, are represented by the lightest greys whereas black represents very dry air. The presence of cloud, which is water in its liquid or solid form, rather than vapour which is invisible to our eyes, complicates interpretation although, in theory at least, it should be possible to measure humidity above the cloud top by utilising the ordinary infrared image to deduce the height and temperature of the cloud top and modify the water vapour radiance accordingly. The length of the path through the atmosphere also has to be considered and this increases with distance from the sub-satellite point.

In spite of numerous difficulties in interpretation it has been possible over the years to develop quantitative uses of the water vapour channel information which are used routinely in numerical modelling of the atmosphere for forecasting purposes.

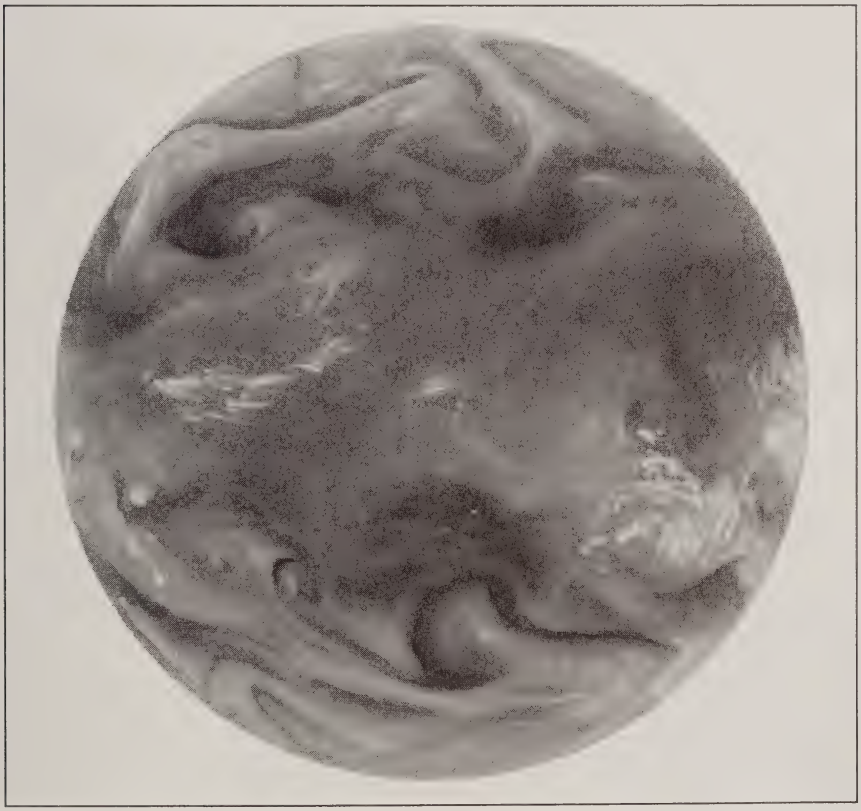


Fig. 1

Looking at figure 1, a full disk WV image received at 1230UT on 19 January 1995, large scale vortices in the upper troposphere are clearly discernible as are the long waves in the flow made evident by brighter bands which can extend for great distances and which can persist for many days. Circulations cannot become established near the equator so this area appears rather chaotic.

Let us now compare two images of the same scene, one in the water vapour channel (Figure 2) and the other in the normal 11 micrometre infrared band (Figure 3). They were received from Meteosat 5's high resolution data channel at 2100UT on 8 January 1995. There are some similarities between the two images. Note that the three major areas of cold, high cloud tops on the IR image (the approaching depression west of the UK, the frontal system from France to the Baltic and the disturbed area in the central Mediterranean) all show as bright areas on the WV image. However, the infrared image indicates that most of Iberia and also northern

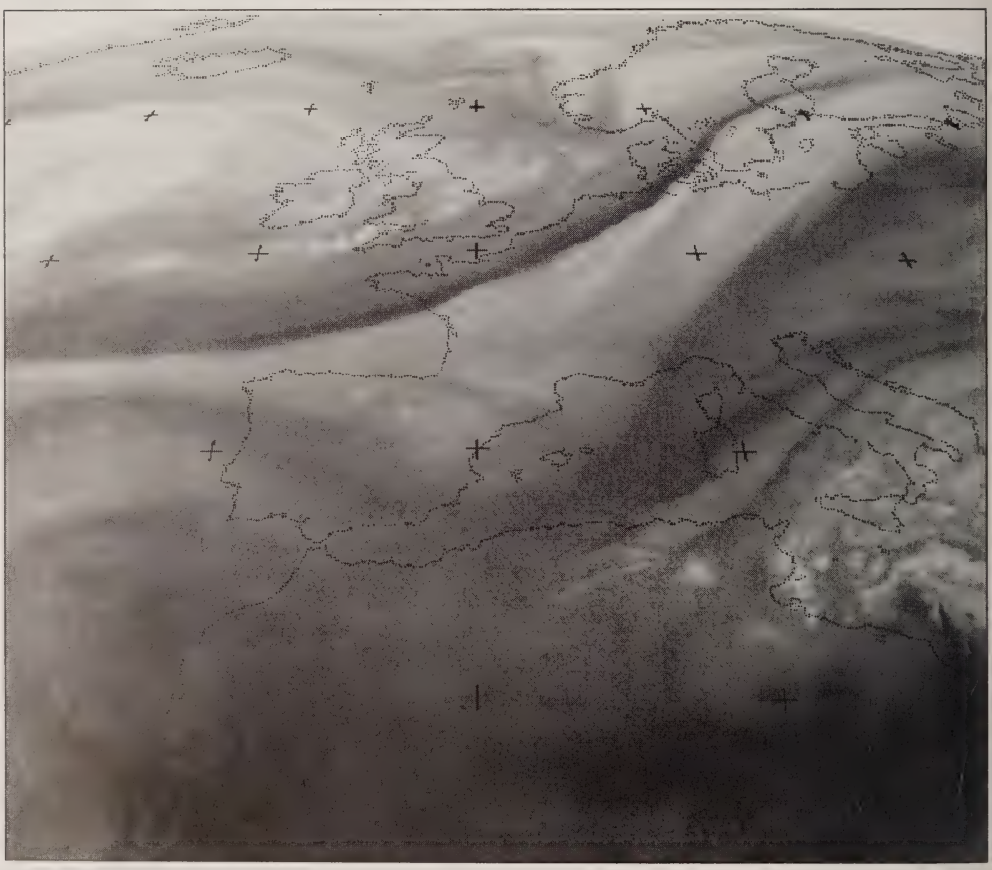


Fig. 2

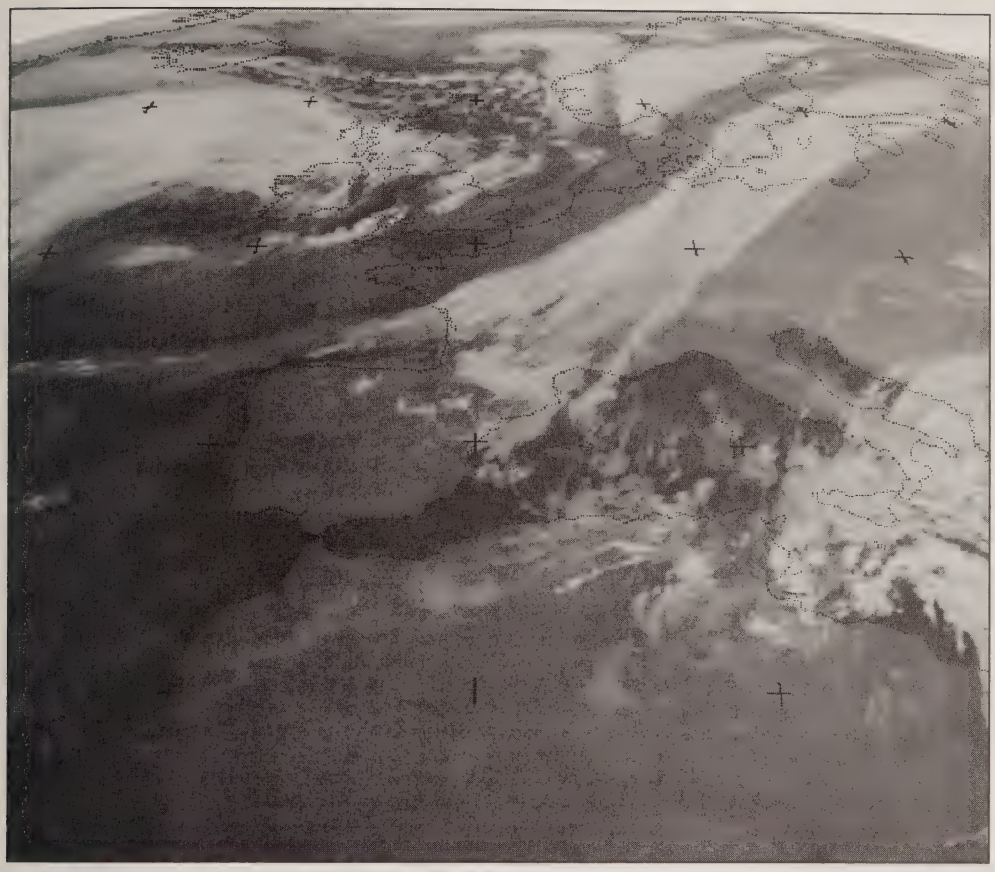


Fig. 3

Italy are cloud-free yet the WV image is fairly bright in these areas. This happens because the water vapour has to be saturated if liquid water droplets or particles of ice are not to evaporate immediately. So bright areas on water-vapour images do not necessarily mean that cloud is present. Sometimes too, cloud can be seen on the infrared images where the WV image indicates very dry air. This phenomenon is commonly seen on Meteosat images of the central South Atlantic where descending dry air creates an almost permanent anticyclone yet the warm sea evaporates sufficiently for extensive cloud cover to form in the lowest one or two kilometres. Remember the WV channel detects water vapour in the upper troposphere, not right down to the surface. The minimum detection height is dependent on several factors and is quite variable but 4km could be taken as a guide. Another very prominent feature on the WV image is the conspicuous dark streak just to the north of the frontal band.

On numerous occasions in this series I have stressed the importance, when interpreting images, of realising that atmospheric motions occur in three dimensions. We are all familiar with surface winds and watching clouds move horizontally but without vertical motion there would be no weather and the English would have little to talk about. This vertical motion is the mechanism whereby water vapour is carried into the upper troposphere and can occur on a very large scale where two air masses of differing temperature meet and the warmer, moist air is forced to rise over the denser, colder air or on the relatively small scale as in convective shower clouds and thunderstorms. In part 7 of this series in March 1994 I explained in simple terms the large-scale global circulation and showed that ascending air was generally associated with low pressure systems whereas in anticyclones the air was generally descending and hence very dry. It would seem reasonable therefore, to interpret bright areas on WV images as areas of moist, rising air and the almost black areas as descending dry air. This is broadly correct. In part 7 I showed that descending air occurs on a large scale in the subtropical high pressure belt and figure 1 does show large dark (dry) zones in these regions on both sides of the equator.

If black areas on the WV images do represent dry air then is there really a narrow strip of such air extending from west of Biscay to southern Sweden and beyond? It was not until the advent of routine radiosonde ascents by balloon around 60 years ago that the detailed structure of the upper atmosphere became known. These instruments measured temperature and humidity and by following them optically (later by radar) winds could also be deduced as the balloon rose through the atmosphere. Not only were narrow bands of very strong winds (jet streams) found near fronts but zones of extremely dry air were also found on the poleward side of the jet streams.

The presence of this dry zone can also be deduced by watching the sky after the passage of an active cold front. Rainfall intensity usually increase quite dramatically as the front approaches and can be intense for a short period. It usually ceases quite abruptly and a rapid cloud clearance follows. The sky often remains cloud-free for several hours until cumulus clouds begin to develop as the zone of dry, subsided air moves away.

Figure 4 is a surface analysis chart based on the one issued by the UK Met Office at Bracknell and timed at midnight, three hours later than the satellite images, and the correlation between the two major low pressure areas and the bright areas west of the UK and over the central Mediterranean is evident. The frontal band on the infrared image and the narrow dry zone on the WV image tie in well with the position of the surface front on the chart. Note how this front is being "killed off" where it trails back into the Azores anticyclone. The infrared image shows a much less prominent front in the high pressure where the upper tropospheric air has

started to descend and warm allowing the water and ice to evaporate. The resultant water vapour is still very conspicuous in this region on the WV image though.

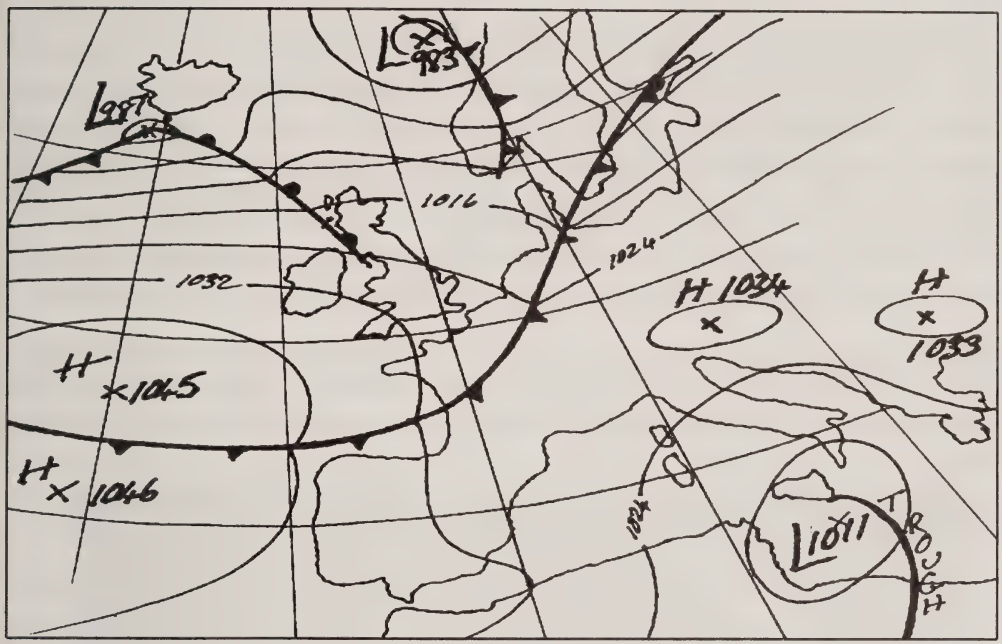


Fig. 4

The forecast significant weather chart for aviation valid for midnight and produced by the Area Forecast Centre in Frankfurt showed a maximum jetstream core speed of 115 knots (about 60 metres per second) at flight level 310 (about 10km) associated with the front over Denmark and southern Sweden. This is not particularly strong by jetstream standards but this front was weakening rapidly as the more northerly system became dominant. However, the dry zone can persist for some time after the winds have relaxed.

Returning to figure 1, it may appear at first sight that the flowing, bright bands of moist air would give an indication of the direction of air movement at the time the image was produced. This is rarely so because of the complex three-dimensional movement of the air and although lare-scale vertical motions are very small compared with horizontal speeds, the resulting change in temperature, and hence radiance, of a sample of moist air makes interpretation very difficult. To follow movement reliably it is necessary to examine a succession of images.

If nothing else, I have shown that these images are not easy to interpret and it is difficult to extract much meaningful information from them but, hopefully, you will now give them a second look. ⊕

ON THE TRACK OF EL-NIÑO

European Space Agency

Every year around Christmas, nature gives the fishermen of Peru a break. When the westerly trade winds weaken in the southern summer, the system of maritime streams running counterclockwise gets out of step: the Humboldt stream, which carries cold, nutrition-rich water northward along the coast of Chile, is pushed aside by warm northbound water moving in from the equatorial region. For centuries, this intermezzo has locally been called El-Niño, the Christ Child. It puts fishermen out of work for a while, but most of the time it also brings the long awaited rain. As autumn moves in and the southern hemisphere begins to cool off, the trade winds regain their force, and with the cold water the fish shoals return.

There are times when this heavenly pause turns into hell, at least for the fishermen. This occurs every few years at irregular intervals when El Niño turns out to be particularly strong and the anchovies stay away longer than usual. Because when that happens, heavy rains strike the coastal deserts of Peru, covering the whole country with a dense layer of green within a few weeks. For the farmers, these are the anos de abundancia, the year of abundance.

Such disruptions of the normal seasonal changes, which occur every few years, not only strike the northwest coast of Latin America: on the other side of the Pacific, in Southeast Asia and India, such seemingly accidental mishaps have been known as long as anyone can remember. One of the first to explore this phenomenon was Sir Gilbert Walker of Great Britain, head of the meteorological observation service in India. He wanted to find out why the rain-carrying monsoon did not materialize in certain years, and he made a very interesting discovery in the process: in normal times, atmospheric pressure over the south Pacific — along the eastern shore of New Zealand, which at that time was also part of the British Empire — was high, while the pressure above the Indian Ocean was low, and this pressure differential boosted the monsoon. But when the atmospheric pressure over the south Pacific weakened, the pressure over the Indian Ocean increased, which kept the monsoon from developing its full force, and the result was a dry year. To describe this pressure transfer, Sir Gilbert coined the term "Southern Oscillation", but he was unable to explain the phenomenon he had observed.

In the eyes of today's climatologists, who, with the help of sophisticated satellites, receive data simultaneously from all corners of the world, this is hardly surprising: "Although Walker already took a trans-regional approach to climate phenomena, his concept was not sufficiently global," explained Professor Klaus Hasselmann of the Max-Planck-Institute for Meteorology in Hamburg. "Because the same years that bring devastating droughts to India give Peru a period of abundance. Now, the Southern Oscillation, which is equally responsible for dry years in India and

the anos de abundancia in Peru, is also held responsible for unusual dry spells in parts of the USA and Australia as well as other irregularities of global weather," Hasselmann added.

Does this make the Pacific the "weather kitchen of the globe"? A fascinating idea that challenges meteorologists and climatologists. Because if it is confirmed, it might facilitate long-term weather forecasts or at least trend analyses. To confirm this hypothesis, scientists need as much precise information as possible to permit mathematical modeling of the processes involved, thus giving them a basis for comparing theory and reality. They not only need the usual data about temperature, atmospheric pressure and wind direction and speed, but also corresponding data on surface water layers which are in constant exchange with the atmosphere.

In this respect, the European Space Agency's (ESA) remote sensing satellite ERS-1 has, since its launch in July 1991, supplied valuable information, which has helped to close this annoying data gap. As Professor David T. Llewellyn-Jones from the

Sunrise over the eastern Pacific as seen by GOES 7 at 1600UT on 3 Feb 1995

University of Leicester explained, its instrumentation is particularly suited to the task of measuring wind and water data simultaneously. "The sophisticated radar system aboard this satellite permits continuous observation of the ocean areas covered, registering the data required to determine wind speed and direction while at the same time analyzing upwellings — continually and globally in a 35-day pattern. A second instrument, the ATSR (Along-Track Scanning Radiometer), scans the surface along the satellite's path, thus providing detailed pictures of the temperature of large distribution of water areas, with a precision of 0.5 degrees." "This precision," says C.T. Mutlow of Rutherford Appleton Laboratory, "is achieved by successively scanning the same ocean surface from two different angles."

Another instrument that proved to be particularly valuable in observing El Niño was the radar altimeter aboard the ERS-1 satellite. It permitted comprehensive measuring of sea level changes, which previously could be registered only by a number of coastal stations. The average sea level indicates the cold and warm ocean currents almost like a map. With the help of these data, scientists in 1991/92 were able to monitor an El-Niño Southern Oscillation practically in real time. Since then, American scientists even succeeded in proving traces of an El-Niño anomaly that had occured ten years earlier, in 1982/83, and is considered to be the strongest El-Niño of this century. Its early development was, almost accidentally, observed by scientists from the Woods Hole Oceanographic Institution and from Duke University in North Carolina, Aboard the research ship "Conrad", which had been sent by the Lamont-Doherty Geological Observatory on an expedition along the equator, they registered, south of Hawaii, the starting point of their journey, a water temperature of 27 degrees Celsius — three degrees above the expected value.

Normally, seasonal wind systems close to the equator push warmer and thus lighter Pacific surface water westward to the coast of Southeast Asia. The atmosphere there heats up, creating a rather durable low-pressure area. At the same time, the air along the coast of Chile and Peru is cooled off by the cold Humboldt stream, thus creating an equally durable high-pressure system. Professor Hasselmann explained the modern view of an El-Niño anomaly as follows: "This pressure differential between the western and the eastern Pacific rim supports the trade winds, which propel the ocean currents during most of the year. If the low-pressure system over the western Pacific is reduced precisely at a time when the trade winds weaken anyhow, the wind direction can, in the extreme case, be reversed and move warm water towards the east."

In the early eighties, these patterns had not yet been fully explored so that the scientists aboard the "Conrad" could not assess the implications of their observations. As the warm surface water reached the west coast of South America, the marine food chain was massively disrupted. Fish shoals moved to other areas, and even the marine birds who normally breed in large numbers on the coastal

islands, were decimated or moved on in search of other hunting grounds. The desert area along the South America Pacific coast experienced extremely heavy rains, causing numerous floods and mud-slides. Thousands of miles to the north, the western United States also registered record precipitation. At the same time, the region on the western Pacific rim (Australia, Indonesia, the Philippines and India) were devastated by a lengthy drought, and even in far-off Africa, the already difficult situation deteriorated further. In its 1994 "Report to the Nation", the U.S. National Oceanic and Atmospheric Administration (NOAA) evaluated the overall economic damage attributable to El-Niño at more than 8 billion dollars worldwide.

In view of such global effects, forecasting El-Niño is of great ecological and economic interest — not only for South America. The first results have been rather encouraging. Once an El-Niño event has been identified, it is, for instance, now possible to forecast its development over an 18-month period with the help of climate models. This can be used to optimize crop planning in Peru: more rice in heavy El-Niño years with strong rains, more cotton in years with little precipitation. Still lacking is a system that will permit forecasting of El-Niño anomalies — probably because not all aspects of a possibly self-regulating system of interactions between the atmosphere and the ocean have yet been uncovered.

The new insights into the "aftermath" of the last major El-Niño anomaly, which, to some extent, were gained with the help of ERS-1 data, can help close this gap. It appears that there is a link between that event and the rise of the surface temperature of the northern Pacific in 1992/93. In the context of a long-term observation between 1986 and 1993, American scientists at the Naval Research Laboratory in Mississippi and at the University of Boulder, Colorado, first registered a slight rise of the sea level along the U.S. west coast, which, beginning in the early nineties, was accompanied by a warming-up of the northern Pacific beyond the 35th parallel. This amounts to a northward drift of the Kuroshio stream, which carries warm, salt-rich water from the western Pacific south of the Japanese islands to the east, making it the equivalent of the Gulf Stream in the Atlantic.

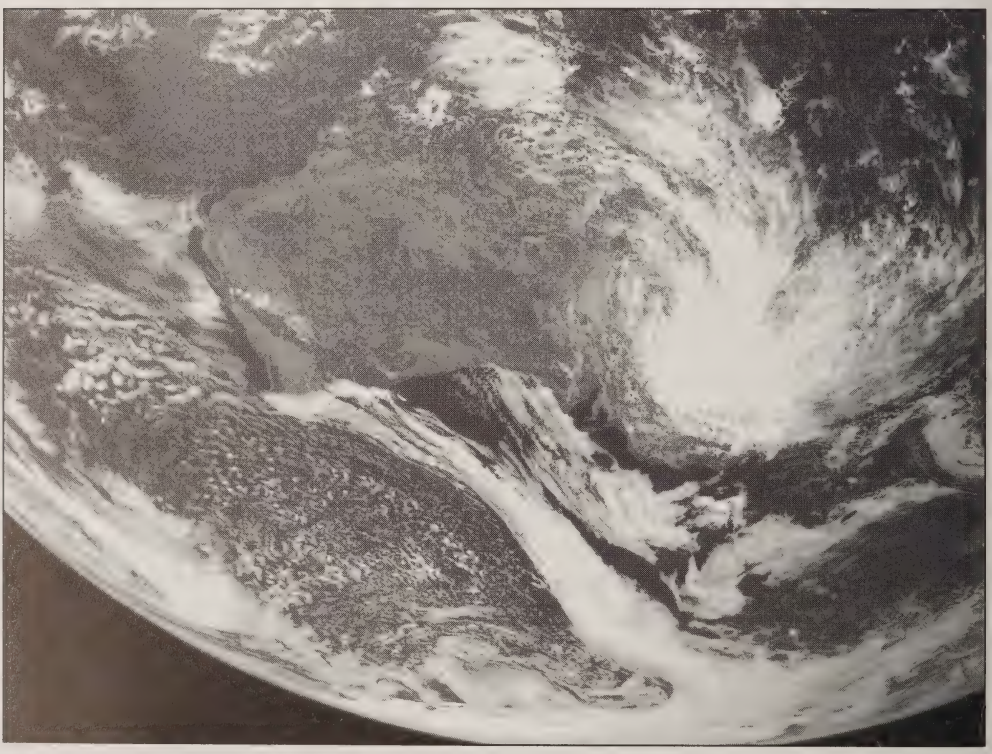
Still open is the question whether the extreme rainfalls in the Mississippi area in the summer of 1993 were related to the migration of the Kuroshio stream and the resulting high-temperature zone in the northern Pacific. But the parallels to the effects of an El-Niño anomaly are striking. Still unanswered is also the question whether — and if so, how — the long-term aftermath of such anomalies can in turn spawn the development of the next anomaly. Early next year, ESA will launch its new satellite ERS-2. The data supplied by ERS-2 from 1995 to 1998 might bring the much-needed clarification, which is indispensible for a reliable prognosis of such events. ⊕

WORLD WEATHER HIGHLIGHTS
December 1994 - January 1995

The exceptionally mild and wet weather continued throughout much of western and northern Europe with all-time temperature and rainfall records broken over a wide area. Serious flooding occcured from France to Poland as well as in the United Kingdom.

Turkey reported an unusually cold December with temperatures as much as 13C below normal. Much of Iran and Baluchistan also had unusually cold weather.

Heavy rain in E Africa in December caused extensive flooding and many fatalities in Uganda. In the following month Zimbabwe, Mozambique and Transvaal had above average rainfall but further west near record high summer temperatures were recorded.



This GMS-4 image, timed at 0532UT 19 January shows the storm which ended the long drought over much of Australia.

Northern China was 9C warmer than normal in December and in the south, and also in Taiwan, little or no rain fell in January. Indonesia received more than its usual deluge in December and in January a tropical storm developed in the Timor Sea which travelled southeast across Australia ending the long drought in most of the worst affected places. Nearly 200mm of rain fell in Alice Springs and almost double that was reported elsewhere.

A persistent southerly jetstream over the central USA maintained the well above temperatures in the eastern States but below average temperatures in the west with devastating rainfall in southern California.

In South America, Argentina experienced a long and very hot spell.

[The information in this report was compiled from several sources but I am especially grateful to the Department of Meteorology at Florida State University. I am also grateful to GSFC, NASA for making GMS imagery available on Internet. -Ed] ⊕

BLUE LEDs

There was much mention of blue LEDs in the RIG Journal a couple of years ago when alternatives to crater tubes were being sought for photographic fax-type machines for direct reception of satellite images. High intensity red LEDs have been available for some time but photographic papers are generally less sensitive to red light. Graham Smith, G1JVZ, tells me that bright blue gallium nitride LEDs are now available from Hero Electronics. The new Nichia range extends to 1,000mcd and the peak wavelength is at 450nm. Price around £30 each for small quantities. Contact Colin Rowe, Hero Electronics Limited on 01525 405015 for more information. Ed. ⊕

CHINA PLANS NEW REMOTE-SENSING SATELLITES

The 17 October 1994 issue of Aviation Week and Space Technology reported that China plans to launch a constellation of ten 250kg remote-sensing satellites, with seven carrying 100m visible imagers and three carrying infrared imagers. The system will emphasize frequent coverage rather than high resolution, with twice-a-day coverage of most areas of Earth giving much better monitoring of fast-moving events like floods than that provided by Landsat and Spot. ⊕

AN UNUSUAL MEDITERRANEAN STORM

Peter Wakelin

"Peter, have you seen the hurricane off Italy?" the voice at the other end of the telephone line said. Hurricane? Mediterranean? January? What had John Tellick spotted, I wondered. That was early evening on 15 January, after the polar orbiters had passed so I looked at Meteosat 5 imagery. There was indeed a bright vortex with an "eye" in the Ionian Sea.

The first image is the 0930 high resolution visible one from Meteosat 5 on the 16th when the vortex was moving south to the east of Malta and the second was sent to

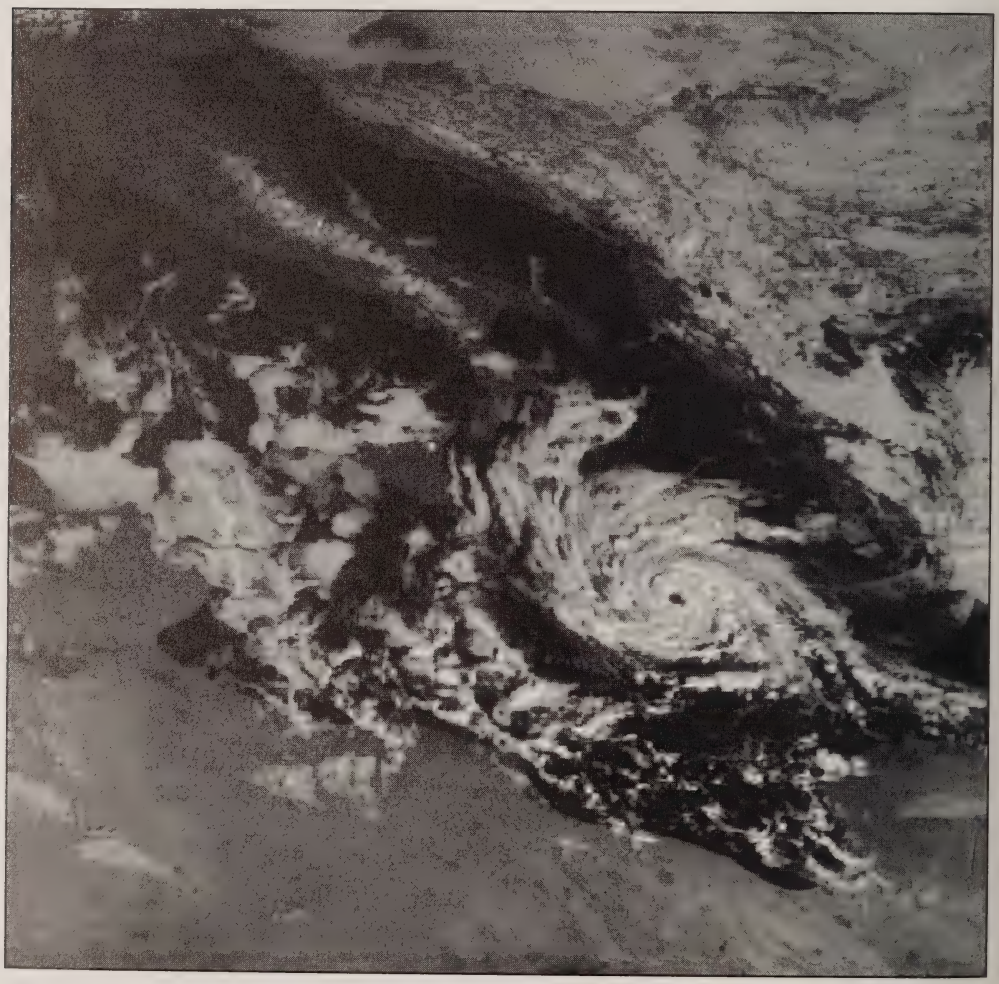


Fig. 1

me by John Tellick and was received from Meteor 3-5 about 4 hours later. The southward motion continued and the vortex dissipated over Sirte on the following day.

Winter is the wet season in the Mediterranean area. Plunges of cold, European air over the still warm sea lead to violent convection and frequent thunderstorms for days on end. They are often associated with rapid rises in pressure over western Europe which cause bitterly cold northeast winds to penetrate the central Mediterranean region where depressions may then form. Such a situation occured in mid January resulting in several days of very unpleasant weather. One ship reported a sustained wind speed of 72 knots before the vortex developed but as far as I can establish from the limited data available to me any circulation at the surface was confined to a very small area. It would appear to have been a phenomenon primarily of the middle and upper levels of the atmosphere.

These severe northeast winds have caused numerous ships to be lost and it was probably such a gale that drove Saint Paul on to the rocks in Malta 1,935 years ago at a point now known as St Paul's Bay. ⊕

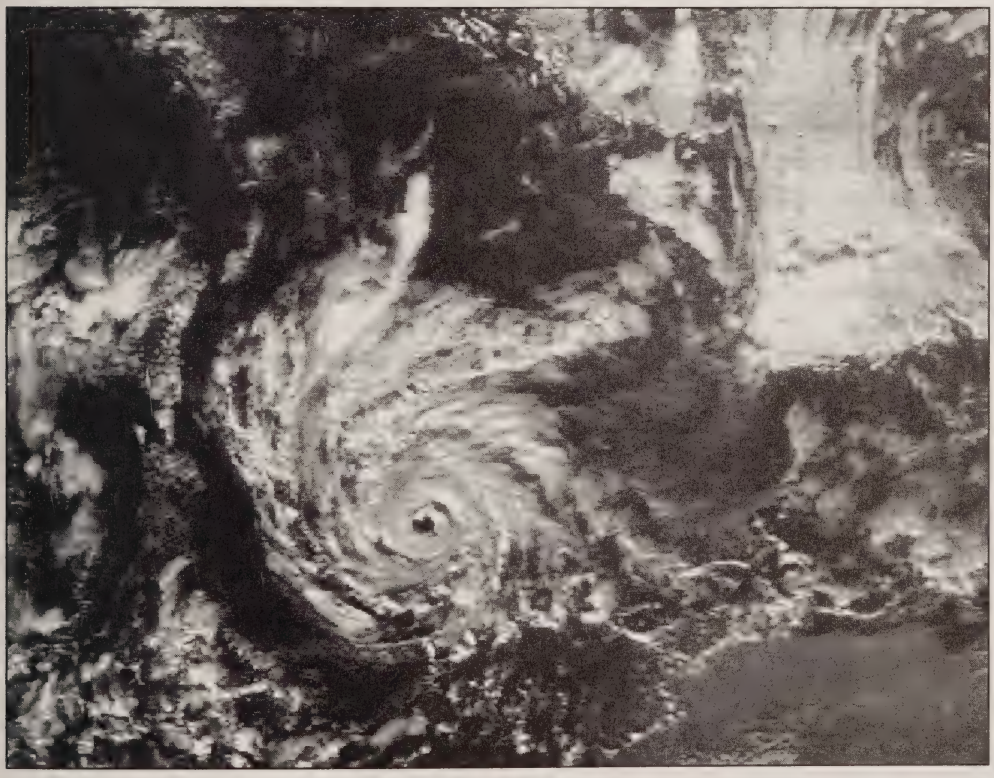


Fig. 2

A NEW WAY OF PRODUCING PRINTED CIRCUIT BOARDS

Graham Smith, G1JVZ

A few years ago I read a book on making printed circuit boards[1]. One method used a photocopier (of the dry toner, heat fusing type), an electric iron and some special transparent film called TEC 200. I tried to obtain a sample from Meadowlake Corporation[2] in the USA after seeing it advertised in "73" magazine but got no reply. "Shortwave Magazine" were interested in testing it but were unable to find a UK supplier.

Recently, I read an article[3] by the film's inventor and saw an advertisment placed by a company that sells it, so I purchased some straight away. Making a one-off PCB using rub-down transfers on to the copper foil is very tedious when several ICs are involved as making the inter-connections is very time-consuming and errors can easily occur. As a diagram of the track layout is usually provided, is seems a shame not to use it directly.

Four steps are involved in in preparing a PCB using TEC 200 film:

1. Make a transparency of the tracks using acetate sheets in the copier.

2. Put this on the photocopier glass (which should be thoroughly cleaned) the wrong way up, with clean, white paper on top and make a second transparency using TEC 200 film in the paper cassette.

3. This mirror-image transparency can then be ironed (toner side down) directly on to the copper foil using a hot iron (cotton/linen setting) with a sheet of paper or cotton between the iron and the film.

4. When cool, the plastic film is peeled off carefully, like a child's transfer. The tracks are left on the board and it is ready to etch.

After practising with about a dozen small transfers from one A4 size sheet, I could successfully do designs with the many thin lines that go between IC pads. The toner melts on to the copper and becomes the etch-resist. If a line lifts up during peeling off then you can lay the film down and go over that area again with the iron using a little pressure. Don't overheat the film or the lines will smudge and the film may shrivel. When the transfer is done you can retouch any small defects with an etch-resist pen.

No ultraviolet light or developer is needed and, to make numerous boards from one design, do several acetate copies, trim them and place on the photocopier glass and make the mirror-image copy as before. Better still, use a computer with a

hand-held or PCB design software and TEC 200 in a laser printer and get a mirror image printed out on command.

If you use the photocopier method, beware that some machines distort the image very slightly. This should not be a problem provided IC pads still coincide with the holes in the board. It is best to get the job done on on a modern, high accuracy, reproduction machine.

I anticipate that this product will save me many frustrating hours in the future. It really does work very well and I have greater confidence in tackling more complex projects.

TEC 200 image film is available from:

PSS Services
217 Prestbury Road
Cheltenham
Glos GL52 3ES
England Telephone/Fax 01242 254108

The price is 75p per sheet up to 39 sheets plus postage and packing at the following rates: 80p up to 10 sheets, £1.00 up to 20 sheets and £1.25 up to 30 sheets.

References:

1. "How to make Printed Circuit Boards with 17 Projects" Kevin R. Graf. ISBN 0-8306-9098-0.

2. The Meadowlake Corporation, 25 Blanchard Drive, PO Box 497, Northport NY 11768, USA.

3. "PCB Production: The Direct Toner Method" Dr R Milker, in "Elektor" Electronics Magazine, February 1995.

FOR SALE. Timestep PROsat receiver, Dartcom preamp, crossed dipole, PCSat 3. £235. Contact G3PYP, Melksham, Wilts. 01225 708816.

FOR SALE. Professional Dartcom APT polar, geostationary system for PCs comprising PC-controlled receiver, DSP interface, cables, software (for WD chipsets-graphics but upgradable to Windows software) plus Landsat disks. As new £425. 137MHz m/head preamp (SSB-German) and Dartcom h/duty turnstile aerial (loft use only) £75. Marconi Trackerball unit (new) £30. Phone Paul G4XHF (evenings) 01293 515201.

TAPE-RECORDED IMAGES AND THE MARTELEC JVFAX INTERFACE

Richard Osborne

As an early user of the Martelec JVFAX interface, I was disappointed to find out that it would not work with signals recorded on audio tape despite instructions to the contrary in the manual. This implied that that its synchronous mode would compensate for the inevitable speed variations of the tape. I established that the interface would perform the the internal analogue to digital conversion synchronously but the data transfer from the interface to the PC was still asynchronous (ie controlled by the timing of the PC). Thus, any attempt to display a picture recorded on tape resulted in an image that slewed uncontrollably across the screen.

To display a recorded image successfully, an interface needs to lock on to the incoming APT signal with a phase-locked loop and provide a timing strobe signal to the PC to tell the JVFAX program when to transfer a pixel value from the interface to the PC. Unfortunately, the JVFAX 7.0 pseudo-parallel data transfer method adopted by the Martelec interface uses all the available inputs on a serial port. In any case, no strobe signal is provided currently by the interface. If one were available, then a special TSR interface could be written for the JVFAX program to react to a strobe on a selected input line.

As I wished to use the interface with tape-recorded signals and was unable to modify the interface or write a TSR driver, another method was needed. I realised that JVFAX would operate synchronously in the true serial input mode, so I designed and built a conversion unit. This contained a phase-locked loop tuned to 2400Hz. This frequency was doubled to 4800 Hz and used to strobe the JVFAX interface. The output from the interface was loaded into an eight-bit latch and then transferred into a UART running at 57600 baud which transmitted the serial data to the PC at a rate of 4800 pixels/second. I have successfully displayed recorded images from NOAA satellites and Meteosat with full automatic phasing. Unfortunately, the data transfer rate does not allow the Meteosat digital header data to be decoded. I have yet to try the Russian Meteor satellite images but I suspect that a 2400Hz external synchronising track is required.

At this point, you may be asking why anyone would want to record signals on tape when live reception is easier. I can think of a number of reasons.

1. The signal can be recorded from a portable receiver or it may be an archive recording.
2. A particular PC may radiate a lot of interference making live recording of signals impossible.
3. A less obvious reason is to keep the electricity bill down as a PC can consume a significant amount of power. To try to catch the elusive Okean 4, I leave my

receiver on continuously and this only activates a cassette recorder when an APT signal is detected. The so-called green or "Energy Star" PCs should be better but I do not know how these interact with JVFAX, especially in the waiting periods between transmissions.

One idea I have had is to somehow encode the MSF time signal in the 2400Hz synchronising track at the time of each recording. On playback, the exact time and date of the recording can be extracted and displayed. No excuses now for forgetting when a recording was made.

RIG*sat*-RX1

PCB for low-cost 137MHz receiver

Michael Gill - G6HOM and Bryan Taylor - G8TPC have co-operated in designing and manufacturing a printed circuit board for the two-channel receiver described in RIG 35. The board is pre-drilled although some holes will need enlarging for component fixings. Scanning is incorporated with PLL signal verification. The performance of the receiver is defined by a high quality crystal filter, obtainable from RIG, giving particularly good adjacent channel rejection. All other components (excepting the channel crystals from McKnight) are available either from Maplin or Cirkit: a full parts list is included with the board. To reduce costs some of the capacitors which can only be bought in multiples of 10 are supplied with the PCB. Also included are the schematic, layout and instructions for building and alignment. Advice and help will be available in case of difficulty. Total cost (excluding case) is about £40.

Prices including post and packing:-

	PCB only	PCB and filter
UK	£7.50	£11.50
Overseas (airmail)	£8.00	£12.50

Order by cheque (sterling pounds payable to 'RIG') from :

Bryan Taylor. 161 Sidegate Lane, IPSWICH. IP4 4JN.

Order by VISA/Access/MasterCard/EUROCARD, quoting card number and expiry date (3% surcharge applies), by mail, from:

Mark Clarke. 9 Park Lane, Bulmer Tye, SUDBURY. CO10 7EQ.

MY CHEAP ANTENNA

John A Boyer.

Introduction

I have always had an interest in weather satellites but it was only about a year ago that I started receiving pictures from them. It began, as these things usually do, on a shoestring budget. Some might say I squeak when I walk but they're wrong. It's the sound of moths trying to escape from my wallet.

I originally used a soundblaster, a scanning receiver and a bit of wire to receive fairly rough pictures. I was rather pleased with myself for having done it on the cheap so to speak. The scanner didn't have enough bandwidth for the APT signal so I was getting crushed pictures and eventually got fed up enough to decide I wanted a 'real' receiver.

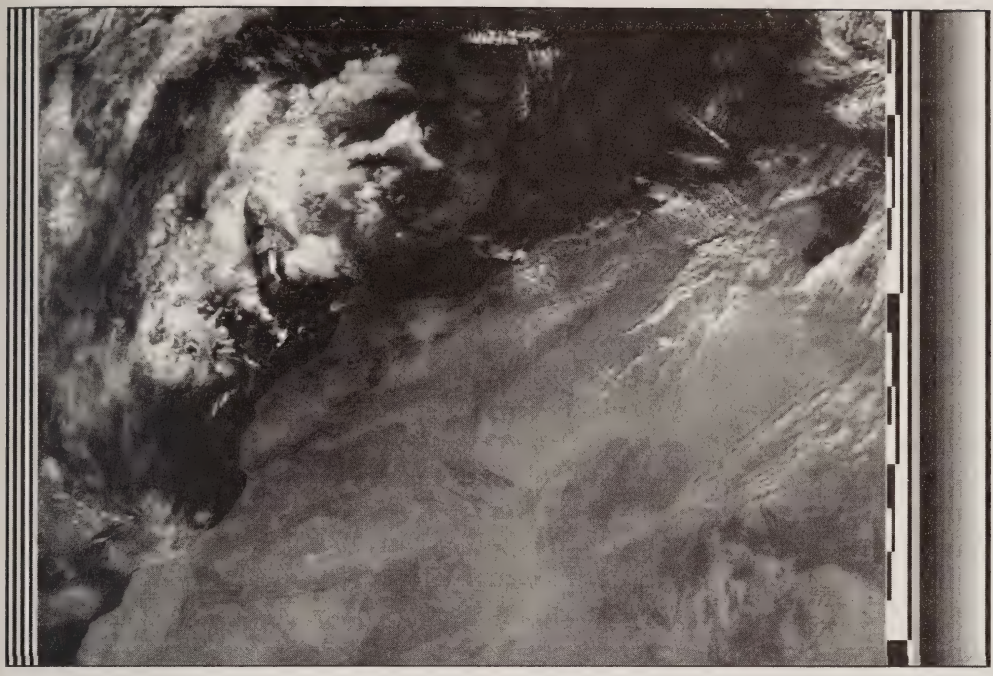
Being the tight person that I am, I wanted to see one of these receivers in action before committing my hard earned money to someone else's bank account. So through RIG I ended up getting in touch with a chap who lives locally and who has a PROscan II receiver. It turned out that he used to work for the same people that I still work for and we hit it off straight away. Then he gave me a real kick up the backside as he loaned me a receiver he had built from a kit. This I might add was the first time he'd met me.

Well, this was it. I got home and decided that I really must do something about that bit of wire dangling out of the scanner that I called an antenna. I quickly built what was going to be a temporary antenna and put it in my loft, where it still resides and provides sterling service.

Construction

The antenna is basically a turnstile. It is made from bits of coaxial cable, a couple of tomato canes and chicken wire I had kicking around. I must stress at this point the constructor must ruggedise this design if the antenna is to go outside. You need a screen for this turnstile so I used a bit of chicken wire that just happened to be around the right size. Use any thing you like; tin foil, chicken wire, it doesn't matter as long as the size of the mesh is less than 15cm. My sheet is about 95cm square. It isn't critical. I wouldn't go smaller than this and would recommend an ideal size of around 1.2m square. This is laid on the joists in the loft.

Then make a cross with two tomato canes or any other bits of wood or plastic that you have. Then add four bits of wire to the cross, making these elements 50cm long. Leave a gap of about 25mm between the wires in the centre of the cross. I



used insulating tape to fix my bits of coaxial cable to the canes making sure that I was connected to the outer conductor, so that I effectively had a thick wire.

The only critical bit of this is the phasing harness. What you might be asking is what's a phasing harness? Well it's quite simple. We want to delay the signal from one of the two dipoles by a certain amount of time. It takes time for radio waves to travel down a wire, so we simply make the signal from one dipole travel through more cable than the other. Ok, I admit it gets a little more complicated as differing coaxial cables have different velocity factors. That really means that as far as radio waves are concerned some cable types will appear longer than others for a given physical length.

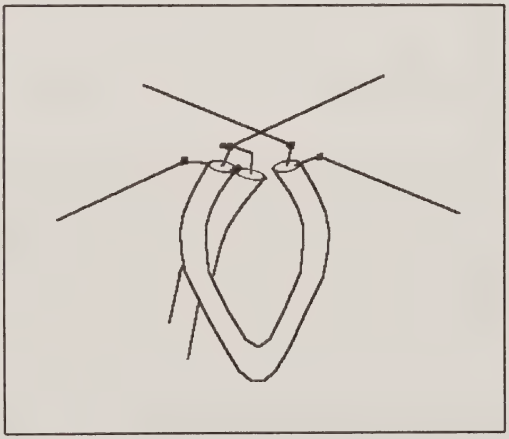


Figure 1

For cables such as URM43 etc that have a solid polythene interior you need a piece 36cm long. Then make short rat tails of the inner and outer conductors

of this piece at both ends. Then cut a length of coaxial cable for the down-lead. Connect the bits of coaxial cable and wire as per Figure 1 and then suspend this about 1.1m above the screen. I know I keep saying about or roughly but the aerial design is not really critical.

Some of you may be thinking that this design sounds rather improbable. You are so right, it is very improbable but it works! I have included an image I received yesterday from Meteor 3-5. This, I might add, is an average pass received through my very rain-sodden roof and was selected for publication because it's the latest pass I could include and not the best one I could find. The satellite was only about 6 degrees above my horizon when over southern Algeria at the bottom of the image.

I would like to finish by thanking my friend Stan Swetman for lending me his receiver. ⊕

RIG HELPLINES - A PLEA

A list of volunteers willing to answer telephone enquiries about specific topics appears in each issue of the Journal. Please, please only ring them with queries on the subject listed. Where specific times are given, please phone only between these times. Some volunteers have indicated that they will request the removal of their names from the list if this request is not complied with. ⊕

BIRD-DOG PROBLEM

Reports are coming in of problems with this tracking programme. It seems it does not like 1995 elements which result in predicted orbits being too far to the east. ⊕

HELP WANTED

RIG is looking for someone experienced in framestore matters who would be willing to deal with the occasional telephone enquiry from members. Anyone willing to have his or her name on the Helpline page is invited to contact the Secretary. ⊕

LATE NEWS

PARABOLIC DISH AND FEED FOR METEOSAT OR HRPT
Continuing the assembly of a station for HRPT reception.

Jean-Claude Beneche - F1AIA
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Translation by Ray Godden - G4GCE

THE DISH

In designing and constructing this dish, the following criteria were considered:

- Low wind load.
- Gain is important, but tracking should not be too difficult.
- Reasonable cost.
- Minimum weight.

I will not go over the physical principles of parabolic dishes, which have been described many times in MEGAHERTZ magazine and RADIO REF, but I will explain the reasons for my choice.

DIAMETER 1.3M
In fact 1.2m would suffice for a gain of about 24dB but I have allowed a small margin to compensate for inaccuracies in construction.

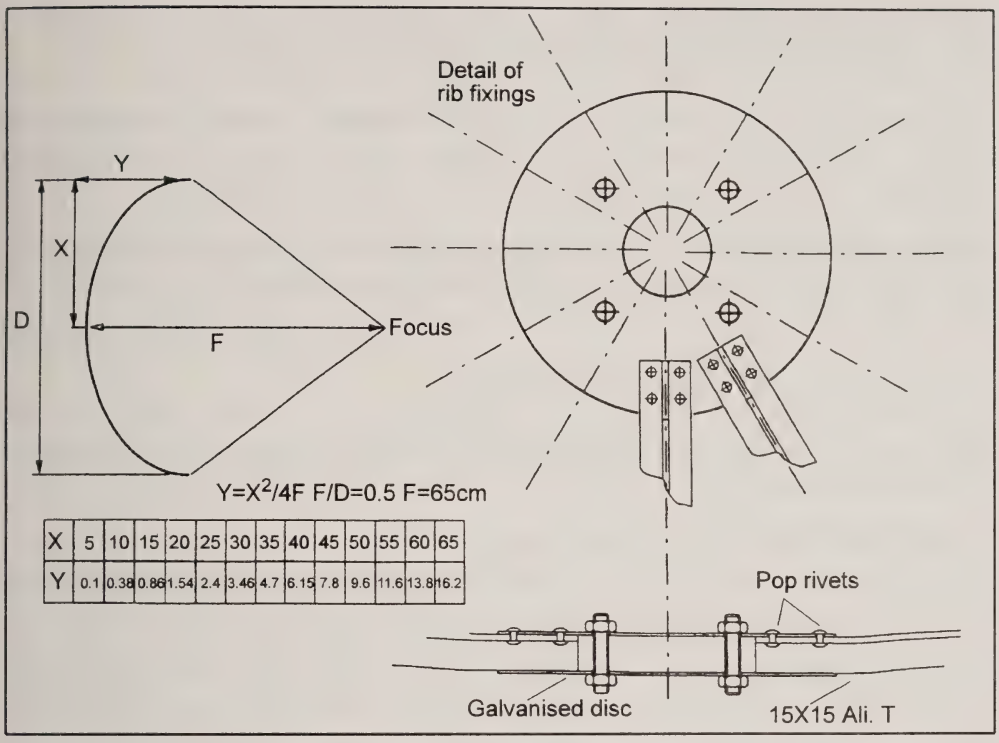
F/D RATIO
I have chosen a F/D (Focal length/Diameter) of 0.5 for this is the best compromise for amateur construction: the tolerance of surface accuracy is proportional to this parameter. Also, illumination of the dish is facilitated.

MESH CONSTRUCTION
In a local DIY store I found some 2mm^2 mesh, stainless steel or painted. This reflects well at 1.7GHz and has low wind loading.

COST OF MATERIALS
The assembly requires:

12 1.5cm aluminium T-section stays
2 galvanised steel plates 10cm or 12cm diameter, 2mm thick
4m 1cm x 1cm L-section aluminium
2 m^2 of mesh
Pop rivets

Depending on the store, the total cost comes to about 500 to 600 Frs (£60 - £70).



X	5	10	15	20	25	30	35	40	45	50	55	60	65
Y	0.1	0.38	0.86	1.54	2.4	3.46	4.7	6.15	7.8	9.6	11.6	13.8	16.2

WEIGHT

The assembly, without feed weighs 3.5kg.

WIND LOAD

This dish and circular feed have been left for 8 months at the top of a 10m mast and have resisted, without problems, storms and snow with winds in excess of 30 knots.

GAIN

By comparative measurements, 24dB is easily attained. A comparison with a solid dish of the same diameter fabricated with epoxy-resin covered aluminium shows no difference in gain. Aiming the dish at the sun increases the received noise level by 10dB compared to a quiet sky area. HRPT images can be received down to about 2° elevation.

CONSTRUCTION

The illustrations show the design features. For rigidity, I added L-section extrusions to join the extremities of the radial stays The mesh is cut into 12 petals and first fixed by galvanised steel wire ligatures every 10cm. Then a piece of 15mm aluminium flat is fixed to each stay by pop rivets to fasten the covering.

Each T-section radial is bent on a former designed according to the table shown. I used my hot water tank for setting the curvature then finalised it with a vice.

This dish works well on other frequencies (1.2 - 2.3GHz); only the gain varies as a function of frequency. For example, at 10GHz a dish of 1.3m has a gain of about 40dB, but, note, a 3 dB beamwidth of only 1.8°.

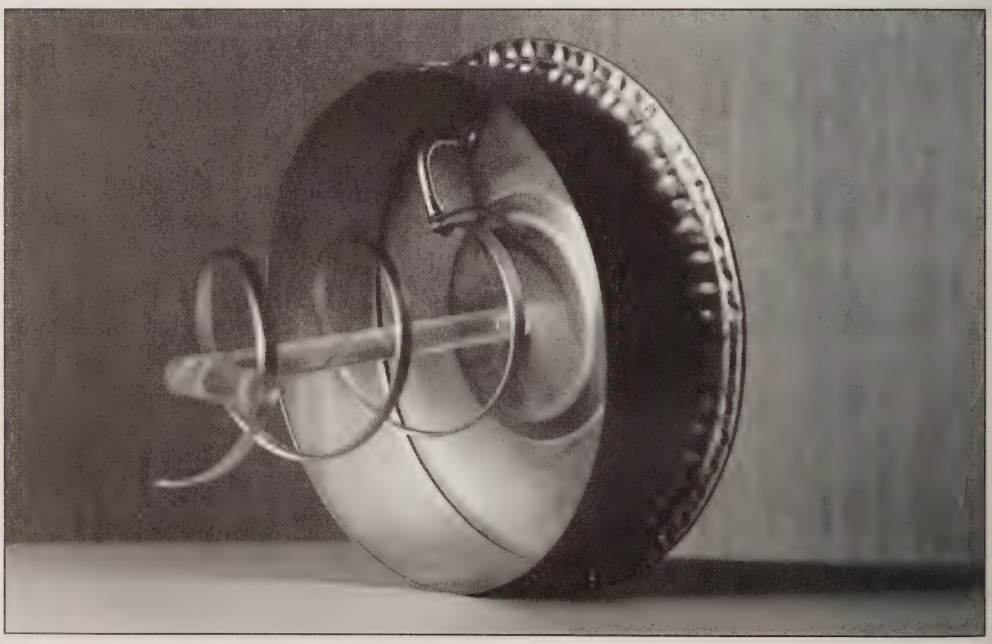
At the HRPT frequency of 1.7GHz the 3dB beamwidth is around 10° fully compatible with an amateur tracking system that I will be describing in the future.

CIRCULARLY POLARISED 1.7GHZ FEED

This feed is usable with all prime-focus commercial or home-brew dishes with F/D between 0.6 and 0.35.

1) FOR METEOSAT WEFAX RECEPTION

Although logically the signals from Meteosat, located above the Gulf of Guinea should be received horizontally polarised in France, it appears that in certain climatic and seasonal conditions the plane of polarisation can be somewhat rotated, possibly up to 90°. (A station in Nairobi receives maximum signal at almost vertical polarisation!). In addition, with the Meteosat over the western Atlantic, the

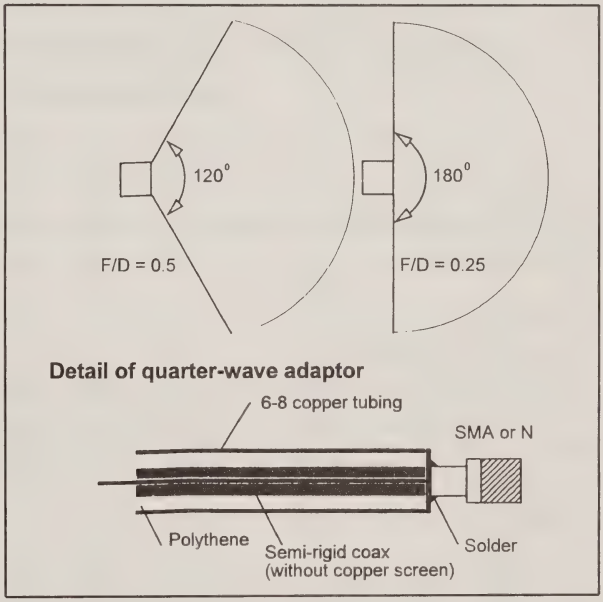


departure from horizontal will be marked. The few dB gained will not be clearly seen on yours PC's screen, but if you process the image, for example, to enhance details or to equalise grey levels, you will see the difference between signal-to-noise ratios differing by only a few dB.

2) HRPT RECEPTION

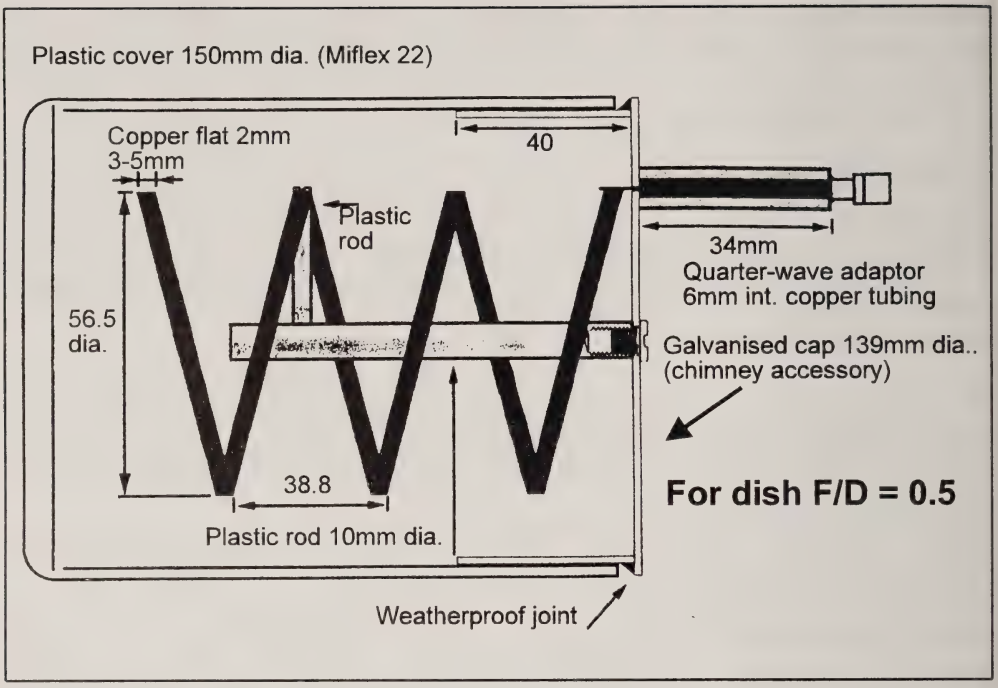
Here the problem is even more crucial, because in digital transmission a variation of antenna gain of 2dB, or even 1dB, has consequences for the BER (Bit Error Rate). Errors in the distinction between a one and a zero in a transmission cause impairments in the displayed image when converted to pixel levels, or even worse, desynchronisation of the image.

The principal concern is not to lose sight of the aim: to win and conserve those precious dB. Many authors use a coffee-can type of feed with two probes set at 90° and use a 3dB hybrid coupler to obtain a right-hand circularly-polarised output. Unfortunately, the use of the coupler inevitably introduces small losses which degrade the NF (Noise Factor) of any high quality pre-amplifier which follows. In an unfavourable case a 3dB coupler can introduce a 1dB signal loss. If you have an excellent pre-amplifier with a NF of 0.5dB the effective NF will be 1 + 0.5 = 1.5dB. You can see that this will compromise the advantage of the LNA. For these reasons I decided to design a helical feed to receive circularly polarised signals. Note that it is left-hand polarised in front of the dish which, by reflection, inverts the sense of polarisation.



CONSTRUCTION

Why have two types of feed (2 turns and three turns)? If you have a dish having an F/D of about 0.25, which has its focus located in the plane of the periphery it needs optimal illumination of practically 180°. For a dish of F/D of 0.6 or 0.5, 120° or 130° will be necessary. This last point is very important because it is not sufficient to possess a dish of 1m or 1.3m, expecting a gain of 22-25dB, if all the signal at the focus is not collected.



With the diagrams and photographs shown, there should be no problems in fabricating this feed.

Materials:-
- Zinc plated steel grill.
- Plastic bowl 2L or 1.5L manufacturer Miflex 20 Frs max. (£2.50).
- Plumber's copper tube 6mm int. dia. 8mm ext. 3cm long.
- Rigid coax 4-5cm long, recovered scrap, otherwise from Cholet.
- 1m copper wire 20/10 or 30/10 or better copper tape 4 X 2mm (silver plated if possible)

I will share with you my little silver plating recipe:
- 10g silver nitrate crystals (pharmacy 5Frs/g) dissolved in 10cl distilled water.
- 200g potassium bitartrate (pharmacy).
- 200g sodium chloride, kitchen salt from the YL(Young Lady)!

To plate the 3-turn copper helix requires 1/3, 1/3 1/3 coffee spoons well mixed to liquid paste - use gloves as silver nitrate burns the skin. Coat the copper with the paste and rub with cotton wool. Repeat several times and rinse off with water. You can get a good, smooth plating: if the effect is too fierce (blackening) adjust the amount of bitartrate.

NOAA 9 PERIOD 101.92 MINS FREQUENCY 137.62MHz

TIME OF ACQUISITION OF SIGNAL - 52.5 DEG NORTH 0 DEG EAST

11/03	09.04	20.36	13/04	10.19	20.10	16/05	09.52	19.43
12/03	10.32	20.23	14/04	10.06	19.57	17/05	09.39	21.12
13/03	10.19	20.10	15/04	09.53	19.43	18/05	09.26	20.59
14/03	10.06	19.57	16/04	09.40	19.30	19/05	09.13	20.46
15/03	09.53	19.44	17/04	09.26	20.59	20/05	10.42	20.32
16/03	09.40	19.31	18/04	09.13	20.46	21/05	10.28	20.19
17/03	09.27	20.59	19/04	10.42	20.33	22/05	10.15	20.06
18/03	09.13	20.46	20/04	10.29	20.20	23/05	10.02	19.53
19/03	09.00	20.33	21/04	10.16	20.06	24/05	09.49	19.40
20/03	10.29	20.20	22/04	10.03	19.53	25/05	09.36	21.08
21/03	10.16	20.07	23/04	09.49	19.40	26/05	09.23	20.55
22/03	10.03	19.54	24/04	09.36	21.09	27/05	09.09	20.42
23/03	09.50	19.40	25/04	09.23	20.56	28/05	10.38	20.29
24/03	09.36	19.27	26/04	09.10	20.43	29/05	10.25	20.16
25/03	09.23	20.56	27/04	10.39	20.29	30/05	10.12	20.03
26/03	09.10	20.43	28/04	10.26	20.16	31/05	09.59	19.49
27/03	10.39	20.30	29/04	10.12	20.03	01/06	09.46	19.36
28/03	10.26	20.16	30/04	09.59	19.50	02/06	09.32	21.05
29/03	10.13	20.03	01/05	09.46	19.37	03/06	09.19	20.52
30/03	09.59	19.50	02/05	09.33	21.05	04/06	09.06	20.39
31/03	09.46	19.37	03/05	09.20	20.52	05/06	10.35	20.25
01/04	09.33	21.06	04/05	09.07	20.39	06/06	10.22	20.12
02/04	09.20	20.53	05/05	10.35	20.26	07/06	10.08	19.59
03/04	09.07	20.39	06/05	10.22	20.13	08/06	09.55	19.46
04/04	10.36	20.26	07/05	10.09	20.00	09/06	09.42	21.15
05/04	10.22	20.13	08/05	09.56	19.47	10/06	09.29	21.02
06/04	10.09	20.00	09/05	09.43	19.33	11/06	09.16	20.48
07/04	09.56	19.47	10/05	09.29	21.02	12/06	10.45	20.35
08/04	09.43	19.34	11/05	09.16	20.49	13/06	10.31	20.22
09/04	09.30	21.02	12/05	10.45	20.36	14/06	10.18	20.09
10/04	09.17	20.49	13/05	10.32	20.23	15/06	10.05	19.56
11/04	09.03	20.36	14/05	10.19	20.09	16/06	09.52	19.43
12/04	10.32	20.23	15/05	10.06	19.56	17/06	09.39	21.11

MORNING PASSES ARE SOUTHBOUND EVENING PASSES ARE NORTHBOUND

TIME OF ACQUISITION OF SIGNAL - 52.5 DEG NORTH 0 DEG EAST

11/03	07.07	18.36	13/04	06.51	18.19	16/05	08.16	18.03
12/03	08.27	18.14	14/04	08.10	17.57	17/05	07.54	17.41
13/03	08.05	17.52	15/04	07.48	17.35	18/05	07.32	17.19
14/03	07.43	17.30	16/04	07.26	18.55	19/05	07.10	18.38
15/03	07.21	18.49	17/04	07.04	18.33	20/05	06.48	18.16
16/03	06.59	18.27	18/04	08.24	18.11	21/05	08.07	17.54
17/03	08.18	18.05	19/04	08.02	17.49	22/05	07.45	17.32
18/03	07.56	17.43	20/04	07.40	17.27	23/05	07.23	18.52
19/03	07.34	17.21	21/04	07.18	18.46	24/05	07.01	18.30
20/03	07.12	18.40	22/04	06.56	18.24	25/05	08.21	18.08
21/03	06.50	18.18	23/04	08.15	18.02	26/05	07.59	17.46
22/03	08.09	17.56	24/04	07.53	17.40	27/05	07.37	17.24
23/03	07.47	17.34	25/04	07.31	19.00	28/05	07.15	18.43
24/03	07.25	18.54	26/04	07.09	18.38	29/05	06.53	18.21
25/03	07.03	18.32	27/04	06.47	18.16	30/05	08.12	17.59
26/03	08.23	18.10	28/04	08.07	17.54	31/05	07.50	17.37
27/03	08.01	17.48	29/04	07.45	17.32	01/06	07.28	18.56
28/03	07.39	17.26	30/04	07.23	18.51	02/06	07.06	18.35
29/03	07.17	18.45	01/05	07.01	18.29	03/06	08.25	18.13
30/03	06.55	18.23	02/05	08.20	18.07	04/06	08.03	17.51
31/03	08.14	18.01	03/05	07.58	17.45	05/06	07.41	17.29
01/04	07.52	17.39	04/05	07.36	17.23	06/06	07.19	18.48
02/04	07.30	18.59	05/05	07.14	18.42	07/06	06.58	18.26
03/04	07.08	18.37	06/05	06.52	18.20	08/06	08.17	18.04
04/04	08.28	18.15	07/05	08.11	17.58	09/06	07.55	17.42
05/04	08.06	17.53	08/05	07.49	17.36	10/06	07.33	17.20
06/04	07.44	17.31	09/05	07.27	18.56	11/06	07.11	18.39
07/04	07.22	18.50	10/05	07.05	18.34	12/06	06.49	18.17
08/04	07.00	18.28	11/05	08.25	18.12	13/06	08.08	17.55
09/04	08.19	18.06	12/05	08.03	17.50	14/06	07.46	17.33
10/04	07.57	17.44	13/05	07.41	17.28	15/06	07.24	18.53
11/04	07.35	17.22	14/05	07.19	18.47	16/06	07.02	18.31
12/04	07.13	18.41	15/05	06.57	18.25	17/06	08.21	18.09

MORNING PASSES ARE SOUTHBOUND EVENING PASSES ARE NORTHBOUND

TIME OF ACQUISITION OF SIGNAL - 52.5 DEG NORTH 0 DEG EAST

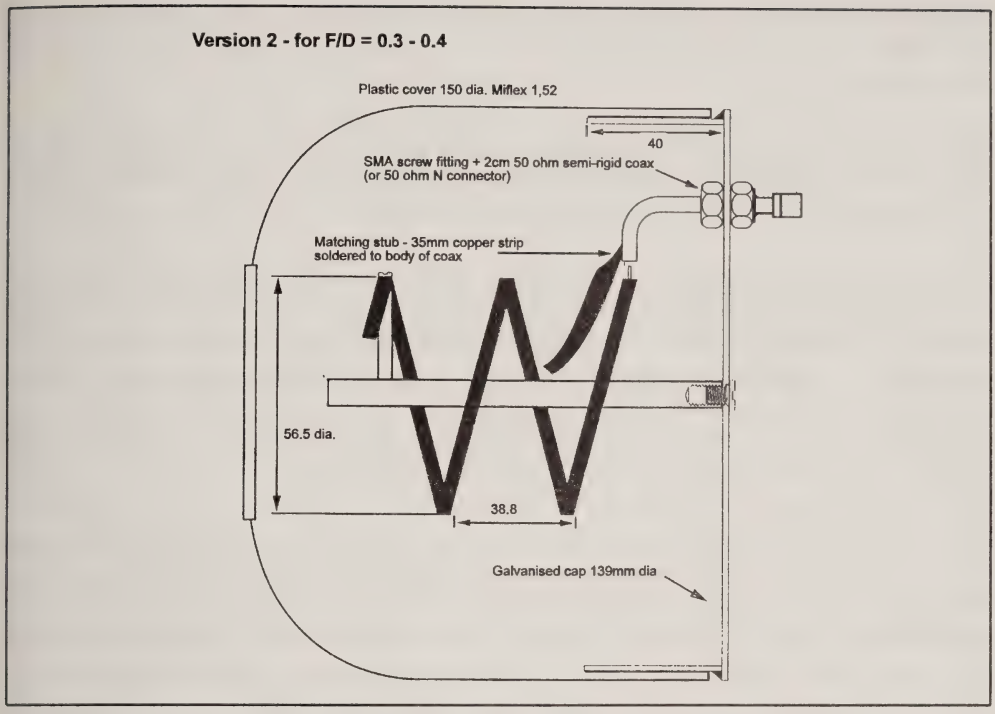
11/03	02.05	11.56	13/04	02.52	12.44	16/05	01.58	11.50
12/03	01.54	13.27	14/04	02.41	12.33	17/05	01.47	13.21
13/03	01.43	13.16	15/04	02.30	12.22	18/05	01.36	13.10
14/03	01.32	13.06	16/04	02.20	12.11	19/05	01.25	12.59
15/03	01.21	12.55	17/04	02.09	12.00	20/05	02.56	12.48
16/03	02.52	12.44	18/04	01.58	11.49	21/05	02.45	12.37
17/03	02.41	12.33	19/04	01.47	13.20	22/05	02.34	12.26
18/03	02.30	12.22	20/04	01.36	13.10	23/05	02.24	12.15
19/03	02.19	12.11	21/04	01.25	12.59	24/05	02.13	12.04
20/03	02.08	12.00	22/04	02.56	12.48	25/05	02.02	11.53
21/03	01.57	11.49	23/04	02.45	12.37	26/05	01.51	13.24
22/03	01.47	13.20	24/04	02.34	12.26	27/05	01.40	13.14
23/03	01.36	13.09	25/04	02.23	12.15	28/05	01.29	13.03
24/03	01.25	12.58	26/04	02.12	12.04	29/05	03.00	12.52
25/03	02.56	12.47	27/04	02.01	11.53	30/05	02.49	12.41
26/03	02.45	12.37	28/04	01.50	13.24	31/05	02.38	12.30
27/03	02.34	12.26	29/04	01.40	13.13	01/06	02.27	12.19
28/03	02.23	12.15	30/04	01.29	13.02	02/06	02.16	12.08
29/03	02.12	12.04	01/05	03.00	12.51	03/06	02.05	11.57
30/03	02.01	11.53	02/05	02.49	12.40	04/06	01.54	13.28
31/03	01.50	13.24	03/05	02.38	12.30	05/06	01.44	13.17
01/04	01.39	13.13	04/05	02.27	12.19	06/06	01.33	13.06
02/04	01.28	13.02	05/05	02.16	12.08	07/06	01.22	12.55
03/04	03.00	12.51	06/05	02.05	11.57	08/06	02.53	12.44
04/04	02.49	12.40	07/05	01.54	13.28	09/06	02.42	12.34
05/04	02.38	12.29	08/05	01.43	13.17	10/06	02.31	12.23
06/04	02.27	12.18	09/05	01.32	13.06	11/06	02.20	12.12
07/04	02.16	12.07	10/05	01.21	12.55	12/06	02.09	12.01
08/04	02.05	11.57	11/05	02.53	12.44	13/06	01.58	11.50
09/04	01.54	13.28	12/05	02.42	12.33	14/06	01.47	13.21
10/04	01.43	13.17	13/05	02.31	12.22	15/06	01.36	13.10
11/04	01.32	13.06	14/05	02.20	12.11	16/06	01.25	12.59
12/04	01.21	12.55	15/05	02.09	12.00	17/06	02.57	12.48

MORNING PASSES ARE SOUTHBOUND EVENING PASSES ARE NORTHBOUND

TIME OF ACQUISITION OF SIGNAL - 52.5 DEG NORTH 0 DEG EAST

11/03	07.52	22.12	13/04	04.27	17.09	16/05	23.50	13.44
12/03	08.18	21.00	14/04	03.15	17.35	18/05	00.17	12.32
13/03	07.07	21.27	15/04	03.42	16.24	18/05	23.05	12.59
14/03	07.33	21.53	16/04	04.08	16.50	19/05	23.32	13.25
15/03	07.59	20.42	17/04	02.57	17.17	20/05	23.58	12.14
16/03	06.48	21.08	18/04	03.23	16.05	21/05	22.47	12.40
17/03	07.14	19.57	19/04	03.50	16.32	22/05	23.13	13.06
18/03	07.41	20.23	20/04	02.38	16.58	23/05	22.02	11.55
19/03	06.29	20.49	21/04	03.05	15.47	24/05	22.28	12.21
20/03	06.56	19.38	22/04	03.31	16.13	25/05	22.54	12.48
21/03	07.22	20.04	23/04	02.20	16.39	26/05	21.43	11.36
22/03	06.11	20.31	24/04	02.46	15.28	27/05	22.09	12.03
23/03	06.37	19.19	25/04	03.12	15.54	28/05	22.36	10.51
24/03	07.04	19.46	26/04	02.01	16.21	29/05	21.24	11.18
25/03	05.52	20.12	27/04	02.27	15.09	30/05	21.50	11.44
26/03	06.19	19.01	28/04	02.54	15.36	31/05	22.17	10.33
27/03	06.45	19.27	29/04	01.42	16.02	01/06	21.05	10.59
28/03	05.34	19.54	30/04	02.09	14.51	02/06	21.32	11.25
29/03	06.00	18.42	01/05	00.57	15.17	03/06	21.58	10.14
30/03	06.26	19.09	02/05	01.24	14.06	04/06	20.47	10.40
31/03	05.15	19.35	03/05	01.50	14.32	05/06	21.13	11.07
01/04	05.41	18.24	04/05	00.39	14.58	06/06	21.39	09.55
02/04	06.08	18.50	05/05	01.05	13.47	07/06	20.28	10.22
03/04	04.56	19.16	06/05	01.31	14.13	08/06	20.54	10.48
04/04	05.23	18.05	07/05	00.19	14.40	09/06	21.21	09.36
05/04	04.11	18.31	08/05	00.46	13.28	10/06	20.09	10.03
06/04	04.38	18.58	09/05	01.13	13.55	11/06	20.36	10.29
07/04	05.04	17.46	10/05	00.01	14.21	12/06	21.02	09.18
08/04	03.53	18.13	11/05	00.28	13.10	13/06	19.51	09.44
09/04	04.19	17.01	12/05	00.54	13.36	14/06	20.17	10.10
10/04	04.46	17.28	13/05	01.20	14.02	15/06	19.06	08.59
11/04	03.34	17.54	14/05	00.09	12.51	16/06	19.32	09.25
12/04	04.00	16.43	15/05	00.35	13.17	17/06	19.58	09.52

FIRST COLUMN PASSES ARE SOUTHBOUND SECOND COLUMN PASSES ARE NORTHBOUND


Version 2 - for F/D = 0.3 - 0.4
Plastic cover 150 dia. Miflex 1,52
40
SMA screw fitting + 2cm 50 ohm semi-rigid coax
(or 50 ohm N connector)
Matching stub - 35mm copper strip
soldered to body of coax
56.5 dia.
38.8
Galvanised cap 139mm dia

Details concerning the $\lambda/4$ match: This type of antenna has an impedance of $Z=140C/\lambda$ at the feed-point. Generally $C/\lambda = 1$ is used, therefore the 140Ω impedance of the antenna is transformed by $\lambda/4$ in the case of 3 turns and by strip line in the 2 turn version. Both work well; the strip line easier to make; the $\lambda/4$ tubular with PTFE insulation more elegant.

Here is how to proceed: Remove 35mm of the copper outer sheath from a 40mm piece of semi-rigid coax, exposing the PTFE insulation. Heat the copper tube and insert 3cm of the polythene insulation from a piece of coaxial cable, for example 50ΩKX4. When the totally inserted insulation has cooled down, drill through a 3mm axial hole to take the PTFE and centre conductor from the semi-rigiad coaxial cable. You have now a homogeneous assembly, without impedance discontinuity with, at the other extremity, an SMA connector (or a good N connector soldered carefully, which will give a little more insertion loss). According to the Radiall specification, at 1.7 GHz an N connector has an insertion loss of 0.1dB whereas an SMA has only 0.05dB. This may seem trifling but nevertheless, it can make all the difference on a pass at the 'daisy level', 2 or 3° above the horizon.

In conclusion, take the time to make one of these feeds, it's worth it and you will be amazed at its performance. I can receive Meteosat channel 1, practically noise-free, with only the 3 turn feed pointed at the satellite! ⊕

THE PRACTICAL ASPECTS OF NOISE ON APT, PDUS AND HRPT SYSTEMS

Ian Hanson

Quite a number of articles have been written about noise and how to reduce it. This one is a bit different; it describes how noise appears on different systems such as analogue APT/WEFAX and digital HRPT/PDUS.

Most RIG members have gone through the time-consuming process of setting up a system to receive the analogue pictures from the NOAA and Meteor satellites and also from Meteosat and will be quite familiar with the type of noise that they get. The noise on these analogue systems has a gradual effect, from a screen full of nothing but 'snow' in an extreme case it gets better and better until you think your picture is noise-free. This is more easily shown on Meteosat by moving the dish around. I will not dwell on this as it is all rather obvious.

When you try to improve a picture by contrast-stretching, any noise that is there will also be stretched and instead of improving the picture it appears very grainy. This effect is even worse if you try any form of 'sharpening' that most image processing software includes. In the winter time the effect of noise is exaggerated as low illumination on visible images and a reduced temperature range on infrared images usually mean that greater contrast-stretching is employed.

There is another form of ever-present noise that all of us who use computers to display weather pictures suffer from without realising it. It will be there even if you have very good antennas, for example, two eight-element crossed Yagis for the polar-orbiters and a two-metre dish for Meteosat. Have you guessed what is causing it? If you said the analogue to digital converter you're right. A to D converters add or subtract a 1 from many of the values they convert due to quantisation distortion. Without getting too technical, quantisation distortion is a measure of the error caused by the conversion process; an analogue signal must be converted to a discrete number of values, usually 256. Let's simplify it by using just 10 levels; 0.1 volts equals digital 1, 0.2 volts equals digital 2 and so on up to 1.0 volt. What do you do with 0.15 volts, is it 1 or 2? Is 0.55 volts 5 or 6? A value is selected but it can never be the correct one. A to D converter 'noise' is more easily demonstrated by looking at a large area of the same brightness; a C1D, C3D, C7D or C9D image from Meteosat is best as these formats show large areas of space beyond the Earth's disk. The space area appears uniformly dark but if you stretch the contrast or, for even more effect, sharpen it, it becomes very grainy.

The effect of noise on digital systems is quite different. Clearly there is no A to D converter needed; this fact alone improves the images considerably. Image processing such as contrast-stretching and sharpening will now bring dramatic improve-

ment to the image. A good HRPT/PDUS image is like a 10 x 8 inch glossy photograph whereas an APT/WEFAX one is like a newspaper picture.

On analogue systems the image gets better and better as the noise decreases, with digital systems it has three steps; (1) no image, (2) a noisy image, (3) a superb image, with the range of (2) being only 0.5 to 1.0 dB. A nearly noise free image is quite acceptable on APT but with HRPT/PDUS it isn't.

To understand the effects of noise we need to know the make-up of a line in a digital image. There are up to five parts to a line; (a) synchronisation word, (b) line number (PDUS only), (c) image, (d) telemetry, (e) grid (PDUS only). A corrupted sync. word means a missing line and on PDUS systems this shows up as a blank line on the screen or, in bad cases, sequential lines can be missing resulting in a very chopped-up image. RIG 35, page 35 illustrates a good example. HRPT sync. noise shows up as disjointed images, not as blank lines. PDUS data have line numbers and noise here produces wrong line numbers which makes the lines jump around the screen as the image builds up. Now we come to the image; noise here shows up as black, white and all shades of grey spots. A pixel is made up of 8 bits for PDUS and 10 bits for HRPT and if a lower value bit is corrupted by the noise the effect will be less noticeable than if a higher value bit is altered. If it should be a dark pixel then it will be brightened and a bright pixel will be darkened. The telemetry section doesn't bother us hobbyists except those parts used for calibrating the temperature readings. Errors here will result in wrong temperatures. There is a large quantity of data in the telemetry section, especially HRPT, that is used by professional meteorologists and it is very important that they have noise free data. The grid data on Meteosat share a characteristic with the sync. words and line numbers; every bit is significant. The grid is sent as a line of bytes whose bits match each pixel on the line and any noise here will show up as white dot(s) on the visual channel and black dot(s) on the infrared channel. If a grid bit was reset I doubt if you would notice it.

How can you be sure your system is truly noise free? Without suitable test gear you cannot and to test it properly you would have to measure the Bit Error Rate. For PDUS/HRPT a BER of 1 in 106 is accepted as giving a noise-free picture which, in real terms, means a single bit wrong in 9 lines of HRPT data or 43 lines of PDUS data.

An example of noise and its effects might be useful. In December 1994 Eumetsat implemented an additional data channel on Meteosat 5 and the power for it was drawn from the PDUS channel. I and many other users were affected by this and our images suffered all the problems mentioned above. However, talking to one PDUS user he said his pictures were OK with the only noise coming from a thermostat in the greenhouse which needed a spark suppressor. Later he said he re-

ceived his PDUS images with the grid turned off as the images seemed better. That's noise, I thought. It probably wasn't the thermostat but he was most likely right on the borderline between noisy and good images. Remember, the difference between no image and a good image is very small with digital systems.

If you have got noise-free images then that's great. If not I suggest you read Dave Cawley's excellent article on page 28 of RIG 26 dated September 1991 entitled 'Noise Figure...Fact or Fiction' which gives good advice on 'tweaking' your system. I am having my LNA modified to bring the noise figure down to 0.5db which should give me noise free PDUS images again.

DID YOU KNOW.....?

...That the Atlas II E rocket used to launch NOAA 14 was built more than 30 years ago as an inter-continental ballistic missile?

...That Lawrence Harris writes regularly on weather satellite matters in the monthly publication "Shortwave Magazine" and includes all the latest happenings?

...That RIG members purchased over 2,200 back-issues of the RIG journal in 1994?

...That city planners in the USA are investigating the possibility of using satellite imagery to determine the state of repair of road surfaces? It seems that there may be a correlation between the condition of an asphelt surface and its "colour" at thermal infrared wavelengths.

...That the Voyager 2 spacecraft, which so successfully imaged the outer planets and is now leaving the solar system, will pass within 0.8 light years of the star Sirius in 358,000 years from now? We will publish the best images in RIG journal 1,432,041 so keep up your subscriptions!

...That the focal length of a parabolic dish antenna can be determined by squaring its diameter and then dividing by 16 times the depth at its centre?

...That a geostationary satellite travels at about 3,074 metres per second?

...That the first RIG committee meeting was held on 30 March 1985, 10 years ago this month, and that Henry Neale and Les Currington have served on the committee continuously since then?

A MESSAGE FROM HONG KONG

Chris van Lint

I became interested in weather related imaging about six years ago when I downloaded a copy of Michael Delahunty's "Radfax" software which I thought was shareware. The program contained some sample images of HF Wfax and I was hooked. Since I had no idea of the hardware required to receive such images, I contacted the author of the software. Michael pointed out that the program was not shareware and included a brochure detailing suitable hardware. I built the "Radfax" decoder, paid for Michael's software and was in business.

At that time I was stationed in New Zealand and had no difficulty in receiving the Australian and Japanese HF Wfax transmissions. In the brochure were details relating to Michael's "Satfax" software intended for decoding APT and signals from the Japanese Geostationary satellite, GMS and, predictably, HF Wfax reception soon became boring. I had built some equipment for receiving aircraft transmissions and after modifications to demodulate FM and increasing the bandwidth a little, I was receiving APT transmissions of sorts.

Shortly after, I was transferred to Korea and was thinking of the next step: GMS. I built a coffee-can type feedhorn and bought a 1.7GHz to 137 MHz down-converter from SSB in Iselslohn. I converted a Sony FM broadcast receiver to 137 MHz by taking a couple of turns off the oscillator and aerial coils and was getting quite reasonable GMS images despite the fact that the bandwidth was not ideal.

Having achieved this, I set my sights on HRPT. In the meantime I had also acquired Timestep's software for APT and was aware of their development of a system for HRPT. I bought their HEMT low noise amplifier, one of the first decoder cards, associated Timestep software and receiver and was on my way. I presently use the above combination of hardware and software with a Kenpro azimuth/elevation rotator. I use a 90cm dish now (I started off with 120cm), because I find the gain is more than adequate and the beamwidth is not nearly so critical. Initially I used circular polarisation, because I was somehow convinced that it gave superior results. In the meantime I had an opportunity to carry out objective comparisons, by changing from circular to linear polarisation instantly by means of a very high performance microwave coaxial relay and I am now convinced that there is very little difference. In fact, once the bird is nearly overhead, circular polarisation seems to give worse performance. Because of mechanical considerations, the combiner vastly increases the chances of losses from creepy-crawlies getting into the system and I have decided that I am better off with linear polarisation.

The az/el rotator is driven either by Instant Track or RealTrack and, although both programs will operate the rotator in the background, I use separate computers

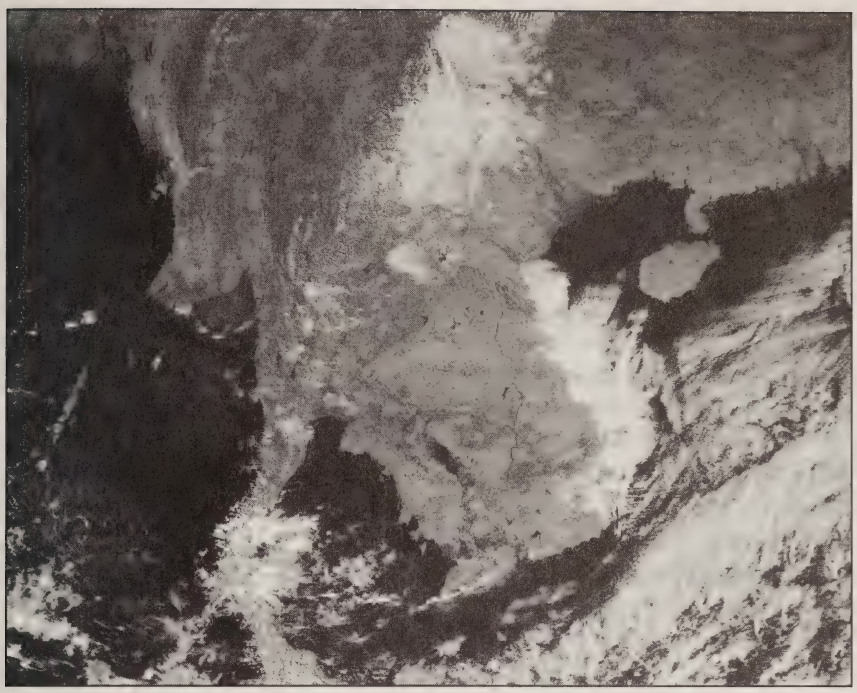
now as it makes monitoring easier. For GMS I also use a 90 cm dish, with an SSB active feedhorn (folded dipole), the SSB down-converter and a custom made receiver from Peter Williams in Brisbane, Australia. The software I use for GMS is Michael Delahunty's "Maxisat", which, in my opinion, is the best software available for geostationary satellites and is also cheap.

While I was in Korea I was living in a house and had two 137 MHz crossed beams mounted on the az/el rotator as well as the dish and was thus able to receive clean APT images using either Timestep's or Maxisat software. I find that the Timestep software is more flexible in terms of image manipulation but the Maxisat appears to give sharper imagery. Here in Hong Kong APT is out of the question as every man and his dog has a pager or cellular telephone and even with Timestep's PROscan receiver the intermodulation is such that it is impossible to get a clean signal for more than a few seconds. Because of space limitations, beams are also out of the question. I have now moved the Lindenblad to the top of the roof and placed the PROscan receiver next to it together with a small, rechargeable lead-acid battery. The aerial feeds into the receiver with 2m of coax and no pre-amplifier to eliminate the possibility of pre-amp induced cross-modulation. A four-conductor shielded wire, 130 metres in length, carries the data and audio down to the PC. Other conductors carry trickle-charge power and control voltages to the control unit. I now get noise-free images on 137.62 but, unfortunately, the interference persists on all other APT channels, including the Russian ones. Using quarter-wave stubbs is out of the question because I have determined with the aid of a spectrum analyser that, in some cases, the interfering station is only 40KHz away!

Because of my location on the ground floor of a very tall apartment block my view is limited to a 180° angle from about azimuth 135 through south to 315. Nevertheless, under good conditions I can get good HRPT images of the northern part of Indonesia, Kalimantan (Borneo) and Sumatra, Indochina, sometimes as far west as India, the Philippines, Taiwan and the southern part of China (Guandong).

I have a large library of 2 and 4-channel HRPT images in the original .HRP format as I keep any interesting images on removable hard disks (Syquest 105Mb). I also have quite a few from my days in Korea on tape, all 4-channel and full passes with up to 80Mb of data per image. If anyone is interested, and has a Syquest 105Mb drive, I would be happy to make copies. I have the Jumbo tape backup system too which I used to use for archival purposes. My address is: c/o Bayer China Co., Ltd., GPO Box 911, Hong Kong. My e-mail address is thai@hk.super.net and I would be pleased to hear from other RIG members who are on the Net.

[Chris recently e-mailed to me the excellent image reproduced here. It is an early image from NOAA 14 (channel 2) timed at 0636UT on 5 January and extends from Calcutta in the west to Hong Kong in the east. Ed.] ⊕



DESCRIPTION OF COVER IMAGES

FRONT COVER: Hartmut Zaun, one of our members from the USA, recorded this NOAA APT image whilst on vacation in Germany using a Sony Mini-disc recorder. It shows nice sun-glint west of the island of Palma. He started colouring images after seeing a presentation by Ed Murashie at the Dayton Hamvention a few years ago and CG Roberts' article in RIG 33 rekindled his interest. He uses the visible and infrared APT images to generate a "hybrid third channel" and processes and combines the three to create a "photo realistic false colour" image.

INSIDE FRONT COVER: These two photographs further illustrate the dish antenna and helical feed described by Jean-Claude Beneche in this issue.

INSIDE BACK COVER: This photograph of NOAA 14 (with solar panels in stowed position) is courtesy of Martin Marietta Space Division and was kindly provided by Dr Jeff Wallach, President of the Dallas Remote Imaging Group.

BACK COVER: This spectacular night-time lift-off of an Ariane 4 rocket carried Meteosat 6 into orbit on 20 November 1993. This Arianespace photograph was kindly provided by EUMETSAT. ⊕

MEMBERS' LETTERS

Dear Peter,

I have been using Jerry Dahl's OFS WeatherFax package for two years now and recently upgraded to his new PCMCIA Convertible card.

I did not have all the problems that Ian Hanson encountered in setting up his system (see RIG 34, p 28). The new version has a simpler setup procedure and no adjustments are required. I think all the bugs found by Ian have been fixed. Page alignment is now controlled by onboard PLL which removes Doppler bending and gain setting is automatic. A feature I particularly like, is the completely automatic operation. The APT carrier is detected automatically and all images over a specified time span are saved. A full NOAA pass is generally about 3.5 Mb, which saves in 5 seconds and takes 2 seconds to retrieve. The map and grid overlays and the temperature calibration have been simplified and work superbly. Images appear to be slightly sharper and have a greater dynamic range than on the earlier version.

I am very pleased with the way the PCMCIA system handles images from the

polar-orbiters but I do not have the facilities to test the geostationary satellite features.

The equipment I use is a RIG Dartcom receiver with a Lindenblad antenna without a preamp. I suffer horribly from 11 kV power-line interference, which sometimes disappears after heavy rain. A new antenna is going up today together with a RIG preamp to try to lessen the high-tension problems.

Thank you for an excellent magazine. Please find enclosed the very first picture (I think!) that NOAA 14 took of New Zealand.

Yours sincerely, Sean Nixon, 10 Carleton Terrace, Tawa 6006, Wellington, New Zealand.

Dear Peter,

Members who use Timestep's PROsatII with a tracking programme other than Track II as shown on the opening screen icon, can still use the icon after making some changes in the MENU.BAT file. See also RIG Journal 39, page 72.

As a safety measure, first copy the MENU.BAT file to a backup disk or directory so you can always restore the original file. Use an ASCII file editor such as the EDIT facility in DOS 6 and go to the root directory of drive C:\ then type edit MENU.BAT. You will be presented with the 35 lines present in the original file. Move the cursor down to line 27, which is the line after ":track". Delete all the 14 lines that follow then type in the following nine lines. Note that I show a carriage return as CR.

"cd\instrak" CR (I am using INSTRAK but you must type in the name of your track file directory).
"set TZ=UTC" CR (Sets your local time zone for the UK to UTC).
"it" CR (Modify the name to match the .EXE file of your tracking programme).
"\menu" CR
"goto dos" CR
":dos" CR
"cd\" CR
"cls" CR
"dir *.bat" CR

Now save this file and exit the editor.

When you access the programme and click on the TRACK II icon you will be presented with your tracking programme. Exit the programme by clicking on the EXIT to DOS icon and all the .BAT files are returned to the screen. If you want to change

to a different programme then change the last line accordingly.

Remember that you will still have to update the elements periodically in two files, ie in the tracking directory via the main menu and the VGASAT4 elements via the UPDATE.BAT file. I have used this modified .BAT file for 6 minths now without any problems.

Sincerely, J Makkinje, 4 Sedbergh Drive, Kendal, Cumbria, LA9 6BJ.

Dear Peter,

My name is Mark Galvin. I joined RIG last year and I would like to know if I am the youngest member, as I am only fourteen years of age.

My receiving equipment, which is the original Mapsat and crossed-dipole, was bought by my father last year and I caught the "bug" although we could not decode any information at that time. Since then, Christmas and birthday presents have consisted of bits and pieces to add to, or improve the system.

I now use JVFAX with the Martelec interface and at first we had problems with the pictures received. They were coming through with very low contrast, but that was recently cured by my father constructing a preamp. As I have only had the interface since Christmas I have not seen any images from the Meteors (I am not sure of the frequencies).

I recently took a NOAA image into school and the geography teachers were amazed at the detail it showed. This was the poor, low contrast APT image so what will they think of the good images I will show them tomorrow? They have also asked me to provide two print-outs per week to display on the classroom wall. I am, of course, trying to convince them how much better Meteosat is and how I could operate the computer for them! So far, all I hear is "How much?"

Can I also say "thank you" to Jim, (G0ILC), as he has helped us every time something has gone wrong and put up with endless questions from me.

Yours sincerely, Mark Galvin, 23 Ward Street, Prescot, Merseyside, L34 6JJ

[Well done Mark! Keep spreading the Gospel. Let's hope you succeed in convincing your teachers of the educational value of satellites. Of course, it is not just geography that benefits. Much basic physics and mathematics can be gleaned from satellites and their orbits. We do not keep records of the ages of members but if anyone out there has orbited the Sun fewer than 14 times they might like to contact Mark directly. Ed] ⊕

SHAREWARE CORNER

Les Hamilton

This quarter's shareware offerings include two items that will prove useful in the field of satellite tracking and prediction, PCTRACK v 3.0 which replaces previous versions, and NOAATIME, a utility prepared by RIG member Jonathan Hewitt. There's also a handy utility ADJCLOCK which automatically keeps the computer clock on time with the minimum of fuss, while for those with an interest in image processing, NEOPAINT V 3.0 has arrived.

You will notice that the Shareware Library Disks have undergone revision and renumbering since the last issue. Many original items have been on offer for two years now, and have clearly been replaced by better and more up-to-date programs. So the Catalogue has been given a Spring-clean, with the best software retained, and new materials added. The current Shareware Catalogue is listed at the end of this article, and will apply throughout 1995. Additions to this listing will be intimated quarterly. The old shareware disks listed in RIG 36 pp 54-56 will remain available, however, for the benefit of new members ordering from back issues. A more detailed and descriptive catalogue is available on the Shareware "Index Disk".

Originally, it was intended that the quarterly compilation disks would only be available for the term of each Journal, but these have clearly been much sought after by new members, and I will therefore retain them as long as interest persists. Note, however, that upgraded versions of shareware will only be found on the current disks.

PCTRACK V 3.0

This new version of PCTRACK supersedes V 2.14 which has been the standard for quite some time and is immeasurably superior, all facilities now being accessible through standard drop-down menus. A map of the World is presented, in either global or Mercator projection, upon which selected satellite tracks and footprints may be viewed in either real-time or accelerated motion. This new version is much easier to operate and will give hours of pleasure and interest, as well as being very useful as a predictive tool.

The program comes complete with sizeable data files for both ground stations and satellites from which the user is free to select those of interest. However, since most of these data apply to the USA, I found it worthwhile deleting these files completely (MSITES.DAT & MSATS.DAT). Although the program reports a 'file

not found' error on start-up, it still allows the import of satellite elements from a NASA 2-line or Amsat Kepler file of your choice, automatically creating a new MSATS.DAT file as it does so. Your own station's location can be entered under the Edit > Sites menu, and this also will be saved automatically in a new MSITES.DAT file.

Another file you may wish to delete is the DEFAULT.PRM file, which contains all the default parameters (colours, active satellites and sites etc.). These reflect the choice of the author. If you now make your own selection of colours, active satellites etc. a new DEFAULT.PRM file will be created automatically. Although this may all seem a little daunting, rest assured that the program is simple to use. There is a 200 kb USERGUIDE.DOC file accompanying the program. [Disk T-04]

NOAATIME

This utility was developed to produce screen output similar to the NOAA predictions in the RIG centrefold. The program is designed exclusively for NOAA satellites, and lists the best morning and evening pass for each for the date indicated by the computer clock. Satellite names are highlighted on screen until after they have passed overhead, providing a quick visual check. Additionally, if the software is left running, a tone sounds one minute before acquisition of signal, the satellite's name being shown in yellow while the time indicator flashes. After the pass, all details are rendered in grey. An accompanying program NOAAMAIN permits the editing of Keplerian elements, and automatically updates the data file used by NOAATIME for displaying its information. [Disk T-03]

ADJCLOCK

This excellent utility is a recent program from Sverre Huseby from Oslo. Every time the computer is switched on, it re-adjusts the clock if it is more than 5 seconds off the mark. So far, it has maintained the accuracy of my own computer perfectly over a 30-day test period. [Disk U-02]

PC-CONFIG V 7.25

This utility is a complete system-info and benchmark program for MS-DOS. It will tell you everything you could ever wish to know about your PC mainboards, CD-ROM benchmark, chip sets, 386 & 486 processor caches and their size (8-256 kb). Identifies Rapid CAD, Cyrix486, Pentium, VGA-card manufacturer, chip-set and BIOS version. Identifies over 600 expansion cards, a variety of hard disk cache software, shows HI-DOS memory under DOS 5, 386MAX, QEMM386 and MOVE'EM, tests for hardware shadow-RAM, for main and VGA BIOS, shows the

physical parameters of ESDI hard disks, identifies SCSI HD-controllers and their manufacturers, establishes the rotational speed of the hard disk etc. etc. [Disk U-02]

SKYMAP v2.0

This is a superb Windows 3.1 Planetarium, which draws accurate maps of the sky and shows stars, planets, deep sky objects, comets etc. Detailed information can be shown for any object, and maps may be output to any printer. Such is the size and scope of this program, it has a disk all to itself. SKYMAP features the fastest screen re-draw for any planetarium simulator I have encountered. Registration is a mere £15 for this excellent item of British shareware. [Disk A-05]

QPEG V 1.3K

Don't be fooled that this is only a minor improvement on V 1.3D. This is a terrific improvement in terms of speed and functionality. Strictly an image viewer, QPEG now loads JPEG files faster than any other program, as well as coping with popular formats like GIF, PCX, BMP. With its handy preview window, it is the ideal image viewer, and must now be regarded as every bit as good as VPIC. Just one tip: Read the documentation, and install the correct screen driver for your graphics card, or you could be very disappointed with its performance. QPEG has its own install routine. [Disk V-01]

GIF2JPG and JPG2GIF

Two DOS command line utilities to inter convert between JPEG and GIF image files. These small utilities are faster and more efficient at making these conversions than most Windows image processors. [Disk I-04]

UPGRADE NEWS

NEOPAINT has already proved to be one of the best and most versatile DOS programs for image manipulation. Version 3.0 adds the ability to handle true-colour (16.7 million colours) images and the facility to save to Windows BMP format. [Disk I-05]

LVIEW has been given a major facelift, and is now offered as LVIEW PRO on Disk I-06. There are also upgrades to both DOS and Windows versions of Graphics Workshop.

The reviewed shareware is offered as the RIG40 compilation disk.

MARCH ADDITIONS TO THE RIG PC SHAREWARE CATALOGUE

Disk A-05	* SKYMAP
Disk I-04	GIF2JPG and JPG2GIF
Disk T-03	NOAATIME
Disk T-04	PCTRACK 3.0
Disk U-02	PC-CONFIG
Disk V-01	QPEG 1.3k

Applications requiring Microsoft Windows are indicated by an asterix (*)

SHAREWARE TITLE CATALOGUE

Disk A-04: Earth Centred Universe, Lunar Eclipse, Skyglobe, Skyview, Solar Eclipse Predictor, Solar System Finder.

Disk A-05: Skymap.

Disk C-02: Hamcomm, JVFAX, Packet Monitor, RTTY_FAX, Satcom.

Disk F-01: CUTNOAA, DATtoPA2, JOIN-PIX, NOATIFF.

Disk I-04: Image Commander, GIF Palette, GIFtoJPG, Iphoto, JPEG4386, JPGtoGIF, Paintshop Pro, Vue Print.

Disk I-05: Graphics Workshop for DOS, IMDISP, Neopaint V 3.0.

Disk I-06: Graphics Workshop for Windows, Lview Pro, Photolab.

Disk T-03: AOS, AOSUS, NOAATime, Predict, SatTrack, Weather Satellite Tracker.

Disk T-04: Bird Dog, PC Track, STS Orbit Plus.

Disk U-02: Adjust Clock, BBC Time, Clockwork, PC Configuration, Fast Geo-chronometer, Geoclock, Make PCB, PKunzip, Screen Thief, SSTV FAX, Weather Forecast.

Disk U-03: RIG Journal Index, RIG Shareware Catalogue, HURRTRAK V 5.0 (1994 version), WINSTORM.

Disk V-01: Compushow, GIFdesk, GIFEXE, GIFREED, QPEG, VPIC, WINECJ.

Belmont Disk: Belmont Image Technician.

HOW TO OBTAIN COPIES OF THE RIG SHAREWARE LIBRARY DISKS

Send up to a maximum of 6 formatted 1.44 Mb MS-DOS 3.5" disks per request, to Les Hamilton, 8 Deeside Place, Aberdeen AB1 7PW, Scotland. Disks must be sent in a sturdy, re-sealable package such as a padded Jiffy bag (or a package within a package), and each separate request must be accompanied by:-

i) a self-addressed adhesive label
ii) stamps for the return postage
iii) coins (or additional postage stamps) to the value of £2.

Note that overseas members return postage is free, but an exchange of shareware or satellite images in lieu is always appreciated.

Any RIG Member coming across any new or updated versions of useful shareware is welcome to send them to me at the above address. Should you experience any problems running any of the shareware from the RIG Library, please enquire by letter, and I'll reply by return of post. ⊕

RIG JOURNAL CUMULATIVE INDEX

Les Hamilton

Have you ever wished, as on many occasions I have, that you could quickly reference related articles from RIG Journals past and present? Almost certainly! As RIG goes from strength to strength, and the Journals grow ever larger and more detailed, it can be a daunting and time-consuming process, poring through index after index. How much simpler it would be to compile all RIG Journal titles into a handy database, with sort and search facilities.

This was the task I set myself a few months ago, and the outcome is RIGINDEX, a Windows™ application which contains information including article titles, authors' names, RIG volumes and page references for, hopefully, every article ever to appear in the pages of RIG. Also included are some items submittted as reader's letters, if they cover a specific topic of interest. The only omissions are regular features (Chairman's Waffle, Kepler Elements, Shareware Corner, GIF Library etc.) which do not generally contain information of enduring interest. But don't worry - there are facilities for you to add these yourself if you wish.

Installing RIGINDEX

The RIG Index comes on Shareware Library Disk U-03 as the self-extracting archive RIG.EXE, along with a few other items including the full, descriptive Shareware Catalogue. When RIG.EXE is RUN, it expands into a directory RINDX11, which contains the compressed Windows™ files. Installation is now continued as

for any windows application, by invoking the SETUP.EXE file, and answering any screen prompts as to the name and location you desire for the RIG index directory (C:\RIGINDEX by default). Everything else is automatic. Once installation is complete, you may safely delete RINDX11 and its contents from your computer as they serve no further useful purpose.

Operating RIGINDEX

On double-clicking the RIGINDEX Windows™ icon, the program loads, displaying a message to wait while the data are sorted. As there are over 450 titles to deal with, there is a delay of a few seconds before an alphabetical list of titles is displayed, each accompanied by the author's name, page reference and Journal number. The list may be inspected by use of the scroll-bar. The menu-bar offers the options <display>, <keyword search> ,<printer> and <edit>.

Display Menu

From this menu you have the options of sorting by Title, Author or by Journal before re-displaying. The sort selected at this stage remains in force during subsequent <search> procedures.

Keyword Search Menu

This option is the most powerful feature of the program, and allows you to enter either an Author's Name or Title Keyword as a search string. For example, entering Smith as the author's name will display all articles attributed to anyone called Smith who has ever appeared in print in the pages of RIG. Entering, say "Meteosat" under the title search will collect and list all titles containing the word "Meteosat". Both searches are case-insensitive, so it doesn't matter whether the keyword is capitalised in the database or not.

Printer Menu

This allows the list currently displayed on screen to be dumped to your default printer. The printer button at the top of the screen also enables this feature. If <keyword search> has not been used, a warning with yes/no option is displayed so that you can exit at this stage if required. This is because printing the entire index can take a considerable time.

Edit Database Menu

This menu allows the addition, modification or deletion of entries. You can add relevant articles as new Journals are issued, or alternatively slim down the database to reflect your particular interests. The <alter> option will enable you to correct any errors I may have inadvertently included.

The RIGINDEX program is available from the RIG Shareware Library, on Disk U-03 or from the RIG Bulletin Board. ⊕

ORBITING UPDATE

ALL THE LATEST NEWS

POLAR-ORBITING SATELLITES

NOAA 14 eventually made it into orbit after numerous delays. The countdown got to within a few minutes of launch on two occasions and 5 other launch attempts were called off at earlier stages in the countdown. Some delays were due to technical problems but strong winds on the surface were to blame on one occasion and strong upper winds also caused delays due to the small risk of debris falling on to Los Angeles should the Range Safety Officer have to destroy the vehicle after lift-off.

The launch window was only 10 minutes wide commencing at 1002UT each day and the Atlas II-E eventually blasted the craft into a near-perfect orbit at the eighth attempt on 30 December. Several RIG members reported hearing the beacon on 136.77 MHz as it passed north over Europe on its first orbit about 75 minutes after launch. On its first pass over the Fairbanks, Alaska, Control Station an anomaly was detected. The nitrogen pressure regulator developed a slow leak immediately after injection into orbit. A relief valve eventually vented as a result of the increased pressure and this resulted in an increase in spacecraft momentum which was successfully removed through normal torquing coil operations. However, attempts to correct the regulator problem led to further venting and eventual loss of attitude control. Within 3 hours attitude control was recovered. The nitrogen thrusters on the spacecraft are used to recover from losses of attitude control and plenty of gas remains. It is not considered to be a mission-threatening problem.

After the initial excitement the routine checkout got underway and the numerous instruments were activated. The AVHRR (Advanced Very High Resolution Radiometer) was activated on 31st and the first images were received the following day. As is usual with these spacecraft, channels one and two are switched on first as the remaining infrared channels' detectors cannot be cooled until out-gassing is complete and the risk of contaminating the detectors is minimal. The first infrared images were reported on 18 January on the HRPT frequency but it was a further few days before channel 4 replaced channel 1 on the APT frequency.

The instruments on board NOAA 14 are similar to those on the earlier ones but the scanning mechanism on the AVHRR has been improved. HRPT users may see a difference. The main improvements APT users will notice are the greater sensitivity of the infrared detectors (those on the older NOAAs have deteriorated signifi-

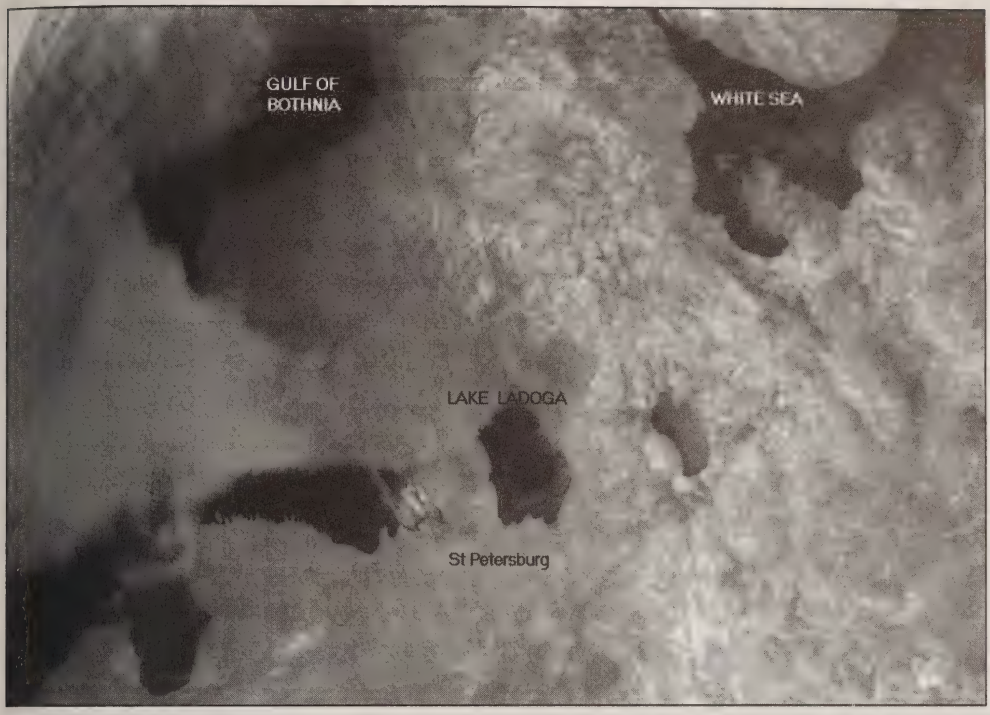
An early NOAA 14 APT channel 2 image received by Steve Henderson in New Zealand on 4 January at 0306UT.

cantly over the years since launch) and the much improved winter illumination. London passes through the plane of the orbit at 1300 and the launch was so accurate that in two years' time it should be only a few minutes later.

NOAA 14 was the last in the series to be launched on an Atlas rocket. The next few will be orbited by Titan 2 vehicles. Future satellites in this series will be very similar but will be equipped with additional thrusters to permit fine-tuning of the orbital parameters to maintain sun-synchronism.

NOAA 9 completed its tenth year in orbit in December and still gives acceptable images. The southbound late morning passes provided the best winter visible imagery prior to the availability of NOAA 14. APT is currently off (in early February) due to VHF conflict with other craft but the HRPT transmitter is on.

NOAA 10 lost attitude control on 24 December reportedly due to its ephemeris having expired but was stabilised three days later. It appears that its sensors were possibly damaged by the sun and lost dynamic range. They have recovered slowly and NOAA still reckon this craft has some value as a NOAA 12 backup. Its APT transmitter was not switched off during the January VHF conflict with NOAA 12 and this caused interference problems to users with omnidirectional antennas.



Peter Wakelin's first HRPT channel 4 infrared image from NOAA 14 received on 19 January at 1112UT.

NOAA 11's imager failed last September but most other instruments continue to function normally.

NOAA 12 is the primary north-bound evening spacecraft and continues to provide very good imagery. Its replacement is due to be launched later this year.

NOAA 13's demise was reported earlier but attempts to contact the craft were made regularly from the USA until the NOAA 14 launch but without success. It was planned to make further attempts at establishing contact from the McMurdo base in Antarctica during the southern summer. It was thought possible that the extended periods of sunlight might enable contact to be established.

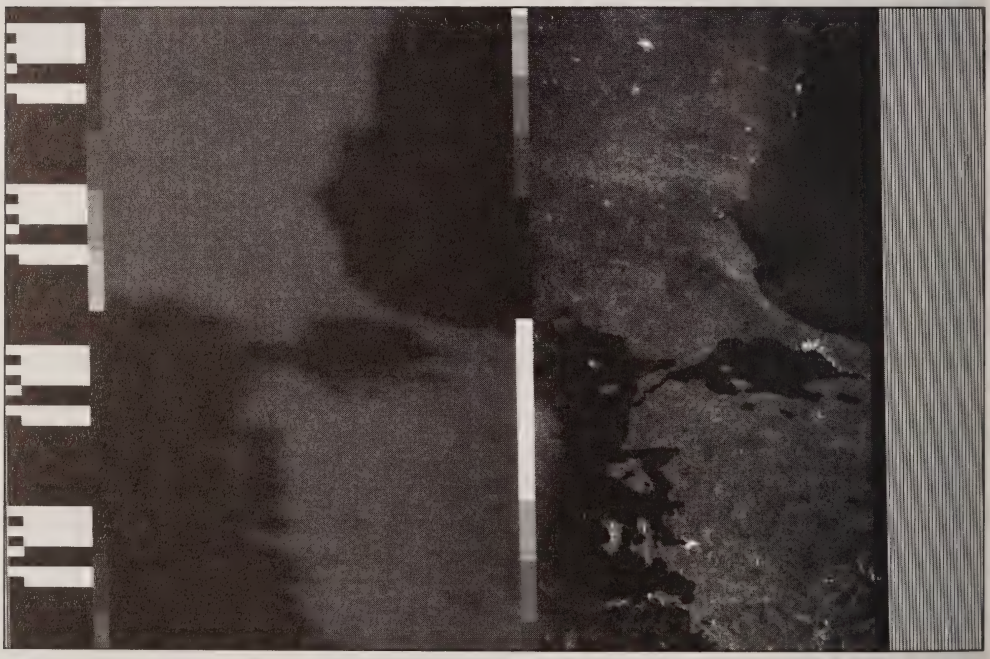
On the Russian scene, METEOR 3-5 was switched off for a few weeks when the ground track was under-illuminated but was back on when the northbound afternoon passes precessed into daylight. By late March these northbound passes will have precessed into the dawn but with the approach of the northern summer the southbound afternoon passes will be improving. Subject to its remaining healthy,

this craft could provide us with good images of high northern latitudes for several months to come. The Total Ozone Mapping Spectrometer (TOMS) on this satellite has now failed.

During the absence of METEOR 3-5 imagery in December, METEOR 3-6 was well placed for imaging but was not switched on. It is a long time since anything was heard from this satellite so it seems probable that it is now incapable of imaging. METEOR 2-21 was on during this mid-winter period but with the usual poor signal strength, possibly attributable to a damaged antenna.

One more spacecraft in the Meteor 3 series remains to be launched. It is now expected in 1996. The next series, designated METEOR 3M, will begin in 1997 and will carry a high resolution imaging system similar to the HRPT system on board the NOAA spacecraft. It will orbit at the lower height of 925km compared with 1200km for the present Meteor series and 850km for the NOAA craft.

The Ukranian-designed and built OKEAN 4 (sometimes referred to as OKEAN 1-7) has provided some very interesting images in the three months since it was launched. As is usual with these craft it was difficult, if not impossible, to tell



This excellent Okean 4 image is courtesy of Denis Bonomo, Editor of MEGAHERZ Magazine and was transmitted on 29 November 1994. The city of Istanbul, Turkey is very prominent.

when it would be imaging. Imaging passes recently (late January) showed 8mm microwave images but the radar was not operating. The earlier Okeans, and the prototypes in the Cosmos series, all suffered from short operating lifetimes but it remains to be seen if OKEAN 4's radar has failed or not. I know that many UK members have failed to catch a single image from this spacecraft and as it does not normally transmit when out of range of Russia, most of our 100-plus members outside of Europe will not have received images either. Also, as it is the first Okean for over three years, I make no apology for reproducing three images here.

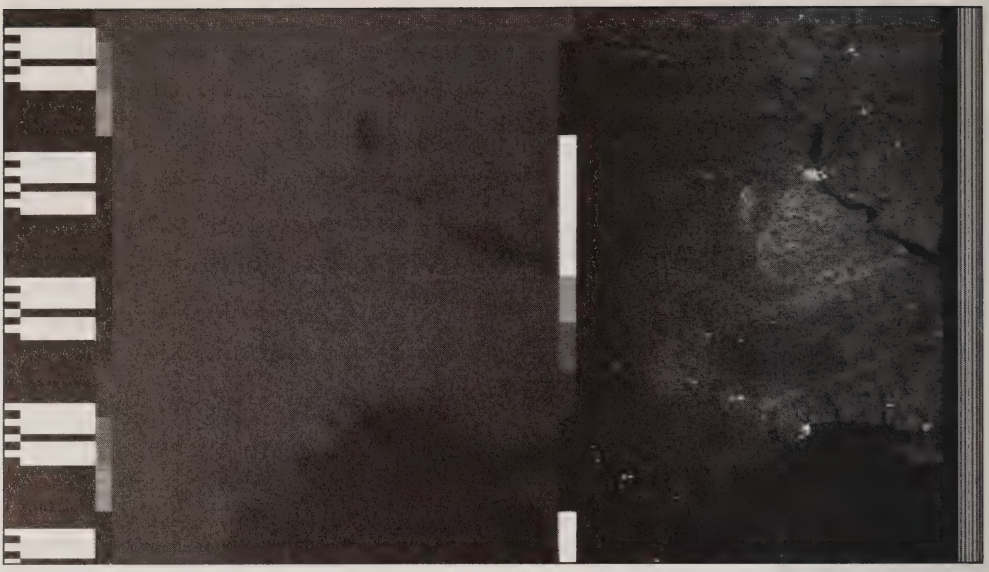
GEOSTATIONARY SATELLITES

METEOSAT 3, which was loaned to NOAA because of the delay in the GOES programme, vacated the 75 degrees west slot in late January to make way for GOES 8. METEOSAT 3 continues to image from its new position at 70W but images will be rectified to appear as though it was still above 75W. The new position will put it above the horizon for the extreme west of Europe. Its ever increasing inclination means it wanders several degrees across the sky during the day with its highest elevation currently occuring at about 0700UT. It will remain at 70W until the end of May when it will be switched off and the small amount of propellant remaining on board will be used to raise it out of the geostationary orbit to avoid collisions with operational spacecraft. Launched in June 1988, it operated for several years beyond its planned life span.

METEOSAT 4 continues in standby mode positioned a few degrees west of Meteosat 5. Regular tests show that it is still affected by the 'fishes' anomaly.

METEOSAT 5 continues as the operational satellite over the

Les Hamilton received a real-time image from Okean 4 at 0604UT on 7 January. The same image was re-transmitted later in the day. The radar image reproduced here shows the ice edge between Greenland and Spitzbergen at upper left while the brightness variations over the sea are indicative of wave height.



The Ukrainian cities of Odessa and Kiev are prominent in this image received by Peter Wakelin at 2059UT on 20 November 1994.

Gulf of Guinea at 0 degrees longitude. The problem with the electronically despun antenna (reported in RIG 39) persists, with a drop in signal strength every 0.6 seconds as the faulty dipoles are directed towards Earth. The introduction of a third MDD (Meteorological Data Distribution) channel has resulted in a slight reduction in power available for the primary data (PDUS) transmitter. Some users of the digital data employing smaller than recommended antennas have experienced an increase in noise levels. Secondary data users are unaffected.

METEOSAT 6 imaging tests resumed on 30 January after decontamination of the infrared detector unit. The ice contamination was permitted to accrue for longer than the usual time in the hope that the decontamination procedure (heating to vaporise the ice) would alleviate the image anomaly. Meanwhile, work continues on the software 'fix' and it is hoped that ESA's commisioning of Meteosat 6 will be completed in May or June with subsequent handover to EUMETSAT.

A new ground station has been built for EUMETSAT at Fucino, Italy and is linked to Darmstadt by satellite. Meteosat 4 transmissions may be used during the commisioning period of this facility in which case users with a smaller than recommended antenna size may experience interference to Meteosat 5 reception.

The aging GOES 7 was moved westwards and is now imaging from 135 degrees west longitude.

GOES 8, launched last April to 90W for a lengthy checkout period was nudged into a slightly lower orbit to begin a slow eastward drift to its operational position at the 75W station recently vacated by Meteosat 3. It is expected to be on station by 22 February. There are still some anomalies to be rectified but they seem to be mostly related to procedural, communications and data processing problems in the ground segment rather than on board the spacecraft.

GOES 9 is currently scheduled for launch on 23 May to 90W for checkout. Later it will be moved westwards to replace GOES 7.

GMS 4 continues to provide good imagery from above 140E.

GMS 5 is being prepared for launch and will include additional instruments. There will be a water-vapour channel centred on 6.7 micrometres similar to that on Meteosat and the thermal infrared channel, although covering the same 10.5 to 12.5 micrometres as GMS 4, will be separated into two windows spanning 10.5 to 11.5 and 11.5 to 12.5 micrometres. Sectorised water-vapour images will be made available to secondary data users too. The spectral bandwidth of the "visible" image will be slightly wider and extend into the near infrared at 0.90 micrometres. This should improve ground detail.

ELECTRO 1 drifted slightly past its 76 degrees east longitude station after launch and had to be lowered a little for a time in order to gain a few degrees of longitude on the earth below. In early January the checkout was reported to be proceding but I am not aware of any imagery having been received from Electro 1 yet.

Acknowledgements: I am grateful to the following for their contributions to this report; Gordon Bridge, EUMETSAT; Dr Donald Hinsman, WMO, Geneva; Gary Davis and others at NOAA/NESDIS and John Tellick, RIG. -Ed.

COSMOS 1766 SHOWS SIGNS OF LIFE.

Just as we were closing this issue for press, Ron Hogben, Stan Teanby and Des West reported Okean-like signals on 137.30 MHz at around 1006 on 6 February. After establishing that Okean 4 had not manoeuvred, and so was not responsible, and no new launch had taken place, old satellites were checked out for a possible candidate. Geoff Perry and Peter Wakelin arrived at the same answer at the same time. Cosmos 1766 was one of the three Okean-like spacecraft given Cosmos designations (see RIG 35) and passed north directly over Britain just after 1000 on 6 February. Occasionally, old satellites do spring into life, but usually after a lengthy period in continuous sunlight. This was not the case in this instance and it is worth monitoring over the coming weeks. Orbital elements are included in this issue. ⊕

KEPLER ELEMENTS

```
NOAA 9
1 15427U 84123A  95037.87150910   .00000044                      1293
2 15427  99.0186  95.7093  0014172 279.0584  80.8969  14.13681741523418
NOAA 10
1 16969U 86073A  95037.97270005   .00000036                       380
2 16969  98.5090  44.8011  0013864 7.8776    352.2615 14.24924001435934
NOAA 12
1 21263U 91032A  95037.92124507   .00000091                      3670
2 21263  98.5957  65.2577  0012047 277.7709  82.2096  14.22491013193876
NOAA 14
1 23455U 94089A  95037.81342563   .00000075                       592
2 23455  98.8887 341.4486  0008914 199.9327  160.1510  14.11488620 5410
METEOR 2-21
1 22782U 93055A  95038.05933042   .00000053                      3781
2 22782  82.5463  20.3115  0021368 291.7190  68.1674  13.83025302 72550
METEOR 3-5
1 21655U 91056A  95038.21453839   .00000051                      7778
2 21655  82.5585 310.7542  0013387 337.0172  23.0345  13.16837109167393
METEOR 3-6
1 22969U 94003A  95037.65464651   .00000051                      1441
2 22969  82.5579 250.8216  0016464 42.1221   318.1151 13.16727042 49706
OKEAN 4
1 23317U 94066A  95034.39571648   .00000253                       400
2 23317  82.5435 158.7536  0024367 265.9394  93.9026  14.73892439 16916
COSMOS 1766
1 16881U 86055A  95036.12969085   .00000715                      2805
2 16881  82.5168 277.4917  0020078 173.7168  186.4270 14.83578857459993
```

Frequencies: NOAAs 9/11 137.62MHz, NOAAs 10/12 137.50MHz
METEORs 137.30, 137.40 or 137.85MHz
OKEAN 4 137.40 MHz
COSMOS 1766 137.30MHz

Explanation of elements format above:

Line 1: NORAD catalogue number, International designation, Epoch, Decay rate (NDOT/2), Bulletin number (thousands omitted), Checksum (1 digit).

Line 2: NORAD catalogue number, Inclination, Right Ascension, Eccentricity (decimal point omitted), Argument of perigee, Mean Anomaly, Mean motion (8 decimal places), Rev. number, Checksum (1 digit). ⊕

RIG GIF LIBRARY

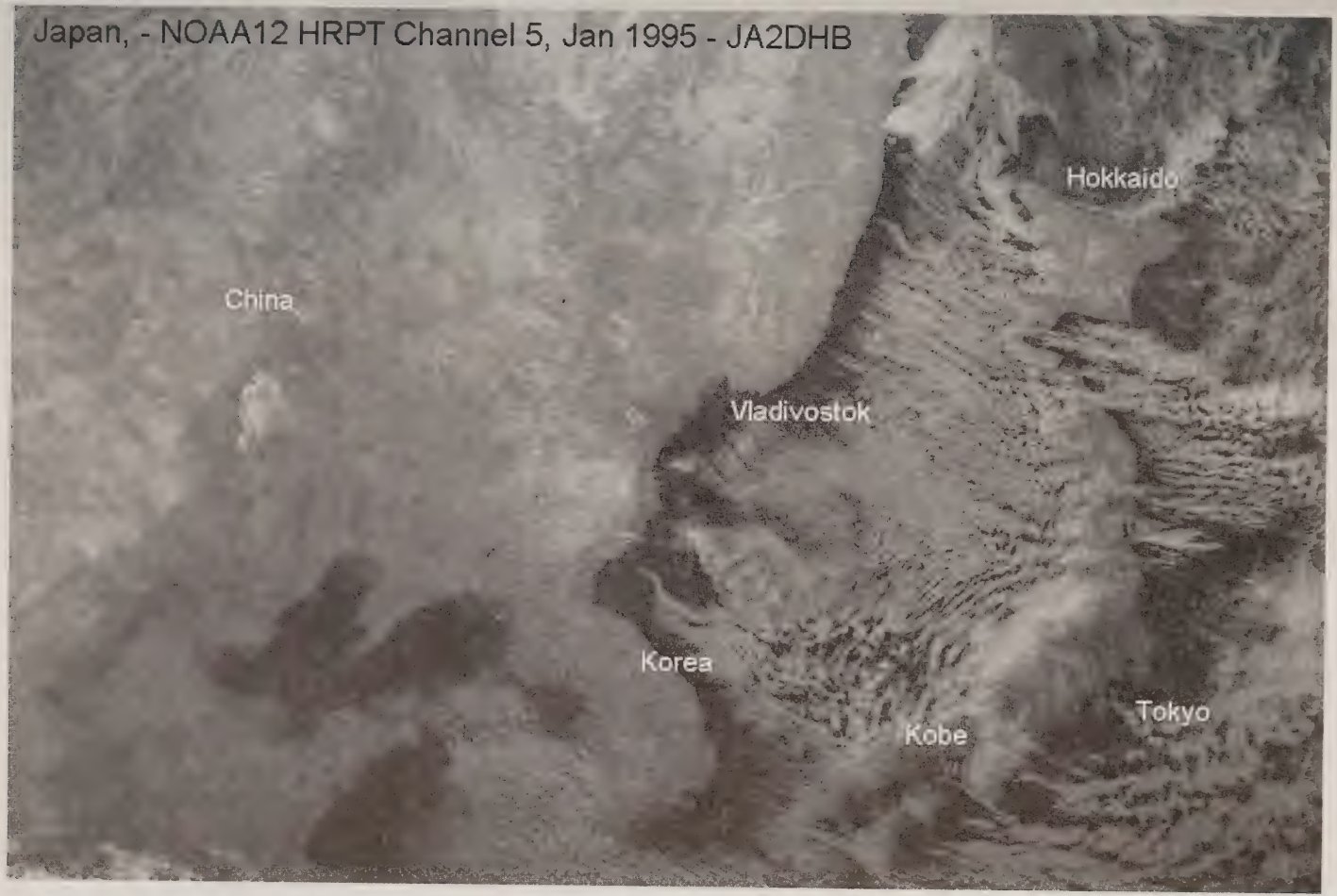
Peter Wakelin

I have recently tried to analyse the sales of disks in 1994 to determine which are the most popular. Obviously, some of the more recent ones have sold fewer copies but there is little doubt that the main area of interest is in the high resolution images, especially those from the HRPT channels on the NOAA satellites. There has been quite a high interest in the high resolution images of Africa from Meteosat (disk 129) and over 70 disks of the Jupiter/comet collision images were requested within a few weeks of the September journal's publication. The least popular ones, by a large margin, are the multispectral images on disks 121 and 126. Quite a few members purchased disk 100, the starter disk, and subsequently came back for others.

I have added three more disks this time; 136 contains images from OKEAN 4 and the other two contain images from the Far East. Nobuhiro Kajikawa in Tokyo sent three good HRPT images for disk 137 and Chris van Lint in Hong Kong has sent a 250Mb tape full of multi-channel data from 6 passes of NOAA satellites. I have extracted enough good scenes to fill the remainder of 137 and disk 138. Chris is sending me some more which were received when he was in Korea. I have received some good images from a couple of our antipodean members too and I hope to add them later. Please keep the images coming. Those from distant lands are especially welcomed.

GIF LIBRARY INDEX

100	VPIC viewing programme with PKUNZIP +8 images selected from other disks. Starter pack with simple to follow instructions.	
101	APT. Mostly NOAA. Some colour. (9 images)	Mainly M Goodall
102	Americas. Mostly HRPT. (14)	
103	Americas. HRPT. (10)	
104	Space Shuttle, Planets. (9)	
105	Miscellaneous. (10)	
106	North America. HRPT, Meteor. (7)	
107	Europe. HRPT. (11)	Marciano Righini
108	Europe, Greenland. HRPT. (9)	Peter Hayes
109	Europe. HRPT. (11)	P Hayes/M Righini
110	Mainly PDUS. (6)	J Brown/M Righini
111	Feng Yun. (5)	
112	Okean. (14)	Mainly L Hamilton
113	North America. HRPT. (7)	Tom Loebl



One of the images on disk 137 from Nobuhiro Kajikawa.

114	Australia, Pacific. (7)	Mainly M Delahunty
115	Mainly N & E Europe. Meteor. (17)	Ulf Jander
116	Europe, Greenland. Meteor. (9)	R Whitby/G Shipton
117	Greenland. Meteor. (4)	
118	Shuttle, Mars. (4)	
119	Various, including Arabia APT. (5)	
120	Jupiter, Saturn and their moons. (10)	
121	Europe. Multispectral. (10)	D Cawley/C Roberts
122	Iceland, Greenland. HRPT. (5)	P Wakelin
123	Europe. HRPT. (3)	P Wakelin
124	Europe. HRPT. (4)	P Wakelin
125	Europe. HRPT. (4)	P Wakelin
126	Europe. Multispectral. (7)	Trevor Smithers
127	Slow-scan IR. Meteor 3-5. (15)	Les Hamilton
128	British Isles. HRPT. (5)	P Wakelin
129	Africa. PDUS. Meteosat. (5)	P Wakelin
130	NOAA 13 images. (5)	
131	Africa/Mid East. NOAA, Meteor. (5)	
132	High res GMS-4 at 140 deg E. (1)	
133	Comet/Jupiter collision. (13)	STScI
134	Rabaul Caldera eruption. (18)	
135	JVFAX images. Meteosat. (6)	Mike Goodall
136	Okean 4. Radar/microwave/vis. (6)	D Bonomo/P Wakelin
137	SE Asia, Japan. HRPT. (6)	N Kajikawa/C van Lint
138	SE Asia. HRPT. (5)	Chris van Lint

HERE'S HOW TO OBTAIN DISKS

The cost is £2 for the first disk plus one pound for each additional disk with no limit to the number ordered. RIG provides disks, packaging and postage. For small orders, UK members may prefer to send postage stamps rather than write cheques for small amounts.

UK members: Cheque or postal order made payable to Remote Imaging Group and sent to Peter Wakelin, 1 Charters Road, ASCOT, Berkshire, SL5 9QF. There is no credit card service for members in the UK.

Other members: Bank draft (in Sterling and drawn on a London-based bank) or Eurocheque made payable to Remote Imaging Group and sent to Peter Wakelin at the address above. Overseas members may prefer to pay by credit card in which case orders (which will be subject to a 3% surcharge) should be sent BY MAIL to Mark Clarke, 9 Park Lane, Bulmer Tye, SUDBURY, Suffolk, CO10 7EQ, UK. ⊕

RIG HELPLINES

General enquiries	John Tellick	0181 390 3315
Meteosat information, NOAA information, Supplier complaints		

A copy of the Group's rules can also be obtained from John Tellick

Russian and Chinese satellite information	Peter Wakelin	01344 23200
HRPT	Peter Wakelin	01344 23200
PDUS	James Brown	01656 782632 *(not available on Sundays)*

Schools/educational co-ordinator		John Tellick	0181 390 3315
Schools/educational enquiries	John Murray	Torquay	01803 386252
	Frank Bell	Godalming	01483 416897
	Tom Walter	Reading	01734 871330
	Bob Coombes	Haslemere	01428 642930
	John Din	Bristol	01454 773387
	Alan Wright	Norwich	01603 713449

Microcomputer specialists:

PC and printer problems	Mark Pepper	01344 777730 *(8.00pm-9pm)*
Commodore Amiga	Chris Pretty	01420 82752
Archimedes	Tom Walter	01734 871330

NOTE: We are grateful to the above members for offering their services to the Helpline. Please do not abuse the service by ringing them for queries other than those listed against their names.

All the helpline numbers listed under Schools/educational enquiries are situated in the south of England. John Tellick (address on page 2) would be pleased to hear from members in the educational field in other areas who would be willing to give help and advice.

REMOTE IMAGING GROUP

RIG SUBSCRIPTION - NEW MEMBER

If you would like to become a member and receive the Journal, photocopy this page, complete the form below, sign the declaration and send it to...

RIG SUB, PO BOX 142, Rickmansworth, Herts, WD3 4RQ, ENGLAND

The subscription rates for 1995 are...

UK membership	£10.00	Europe outside EC	£12.00
Europe EC	£12.00	Outside Europe	£14.00

Name _____ Call Sign (if any)_____

Address. _____

_____

_____Post Code_____

Country _____ Telephone No._____

Are you receiving:
Polar-orbiting Weather Satellites _____ Geostationary Weather Satellites _____

Do you require back issues? (see Rig Shop Corner) _____

Amount Enclosed £_____

Payment by Visa/MasterCard/Eurocard - there is no surcharge:

Card No._____ Expiry date_____

Signed _____ Date _____

Are you willing to have your name/address made known to members in your area? YES / NO. *(Delete as applicable)*

DECLARATION: I do NOT object to the Remote Imaging Group holding my Membership details on a computer.

Signed _____ Date _____

RIG SHOP CORNER

ALL PRODUCTS ARE FOR SALE TO RIG MEMBERS ONLY, FOR THEIR OWN PERSONAL USE AND NOT FOR SELLING-ON.

IN THE EVENT OF PROBLEMS WITH EQUIPMENT PURCHASED FROM RIG PLEASE CONTACT RIG IN THE FIRST INSTANCE AND NOT THE MANUFACTURER.

All prices shown include post and packing except where marked

Receiving / Decoding Equipment	**UK/EC Price**	**Overseas Price**
RIG DARTCOM Meteosat Downconverter. Assembled and tested module in tin plate box	£155.00	£132.00
Complete, assembled and mounted in weather-proof box.	£190.00	£162.00
RIG DARTCOM VHF Scanning Receiver. Assembled and tested module with LED channel number display.	£135.00	£115.00
As above but with LCD frequency read-out instead of LED channel number display. *Both the above items are modules and require a box, together with several components, switches, etc.*	£179.00	£152.00
RIG VHF Preamp. Includes a bandpass filter and is ideal for mast-head mounting. Assembled/tested module; needs boxing.	£18.00	£16.00
RIG 1695MHz Low Noise Amplifier kit. *Experienced constructors only.*	£29.00	£25.00
Martelec JVFAX Interface Unit Connecting lead £5 extra (specify whether 25 or 9-pin required)	£78.00	£70.00

Antenna systems	UK/EC Price	Overseas Price
RIG CROSSED DIPOLES A Turnstile type design, in kit form	£26.00	*(UK Only)*
RIG/TH2 47-element YCV loop Yagi (1.7GHz)	£85.00	*(UK Only)*
DISHES *1.0 Metre (dish only), nearly new condition*	£25.00+P&P	*(UK Only)*
DISH FEEDS	£25.00+P&P	*(UK Only)*
JAYBEAM 5X-Y 2m 5 element crossed Yagi, in kit form	£55.00	*(UK Only)*

RIG Binders

Available by post from Gordon Fleming, 168 Blythway, Welwyn Garden City, Herts. AL8 1DU. UK Price £4.00 each, EC/European Price £4.50, Outside Europe Price £5.00. Cheques to *"REMOTE IMAGING GROUP"* please.

CD-ROMS	UK Price	EC Price	Other Price
ERS-1	£12.00	£13.00	£14.50
Meteosat	£12.50	£13.50	£15.00

Back Issues of RIG Journals

		UK Price	EC/Europe Price	Outside Europe Price
RIG 8-11	1987	£5.00	£6.00	£7.00
RIG 12-15	1988	£5.00	£6.00	£7.00
RIG 16-19	1989	£5.00	£6.00	£7.00
RIG 20-23	1990	£6.00	£7.00	£8.00
RIG 24-27	1991	£6.00	£7.00	£8.00
RIG 28-31	1992	£6.00	£7.00	£8.00
RIG 32-35	1993	£6.00	£7.00	£8.00
RIG 36-39	1994	£6.00	£7.00	£8.00

Note: Prices quoted are for a set of four, including Post and Packing.

RIG 1-7 are currently out of print. Owing to depletion of some issues, photocopies may be supplied. Individual issues are no longer available (hardship cases excepted).

Ordering Information

All items are available from the Editor, Peter Wakelin and include return by UK 1st class mail (except antennas and Journals). Items to non-UK addresses sent via air-mail.

UK VAT is now applicable on sales to the following EC countries - France, Germany, Belgium, Portugal, Spain, Republic of Ireland, Denmark, Italy, Luxembourg, Netherlands, United Kingdom (including Isle of Man). Members in these countries should use UK/EC price when ordering. EC members who are registered for VAT must forward their VAT registration No. to the Treasurer to enable them to receive VAT exempt goods.

As UK/EC prices now include VAT where applicable; receipts will be issued upon request. Remote Imaging Group VAT Registration No. 594 7483 83. Channel Isles: divide by 1.175 to remove VAT content.

UK members, By Cheque or Postal Order.

Overseas members, Pay by Bank Draft (drawn on a UK London-based bank) or Eurocheque(s). (Payments to a Maximum of £100.00 in any one Eurocheque). No local currency please.

All cheques made payable to *"REMOTE IMAGING GROUP".*

Credit Cards Accepted (Access/Visa/Mastercard/Eurocard) Add 3% to Total. Available by MAILORDER only from the Treasurer, Mark Clarke, 9 Park Lane, Bulmer Tye, Sudbury, Suffolk, CO10 7EQ.

Please state type of card, Card No., Expiry Date.
All Credit Cards authorised before goods are despatched.
(Note: Ordering by Credit Card does not mean instant despatch!)

FOR SALE. Back Issues - complete set to issue 38, including the rare 1-7 issues. £45, including postage. Rob Davis, 0473 610481. Email rob.davis@bt-sys.bt.co.uk

FOR SALE. AVT by Black Belt Systems, works with Amiga 500 for transmitting and receiving SSTV and FAX, boxed, as new with manual and cable. Can demonstrate or post. £125 Ken Gill, Leeds, 0532 562746.

BULLETIN BOARDS

Orbital elements and other information of use to members are available from several electronic bulletin boards. The three listed below all offer free service and are available 24 hours a day. In addition to orbital elements (in both Amsat and NASA 2-line formats), the RIG and Timestep services include regularly updated weather satellite status reports indicating which ones are transmitting and their frequencies. The RIG board also offers a range of shareware programmes.

Telephone numbers:	RIG BBS	01945 440666 8bit, no parity, 1 stop bit
	Timestep BBS	01440 820002 8bit, no parity, 1 stop bit
	Dartcom BBS	01822 88249 8bit, no parity, 1 stop bit

RIG AT RALLIES

RIG has revised its rally diary for 1995. We shall be attending the following and look forward to seeing you. We will be showing RIG products and demonstrating imaging etc.

Picketts Lock - Lee Valley Leisure Centre	11, 12 March
Elvaston Castle, Derby	11 June
Longleat, Wiltshire	25 June
Leicester	20, 21 October

Plus, of course, the Conference and AGM at Guildford on 29 April.

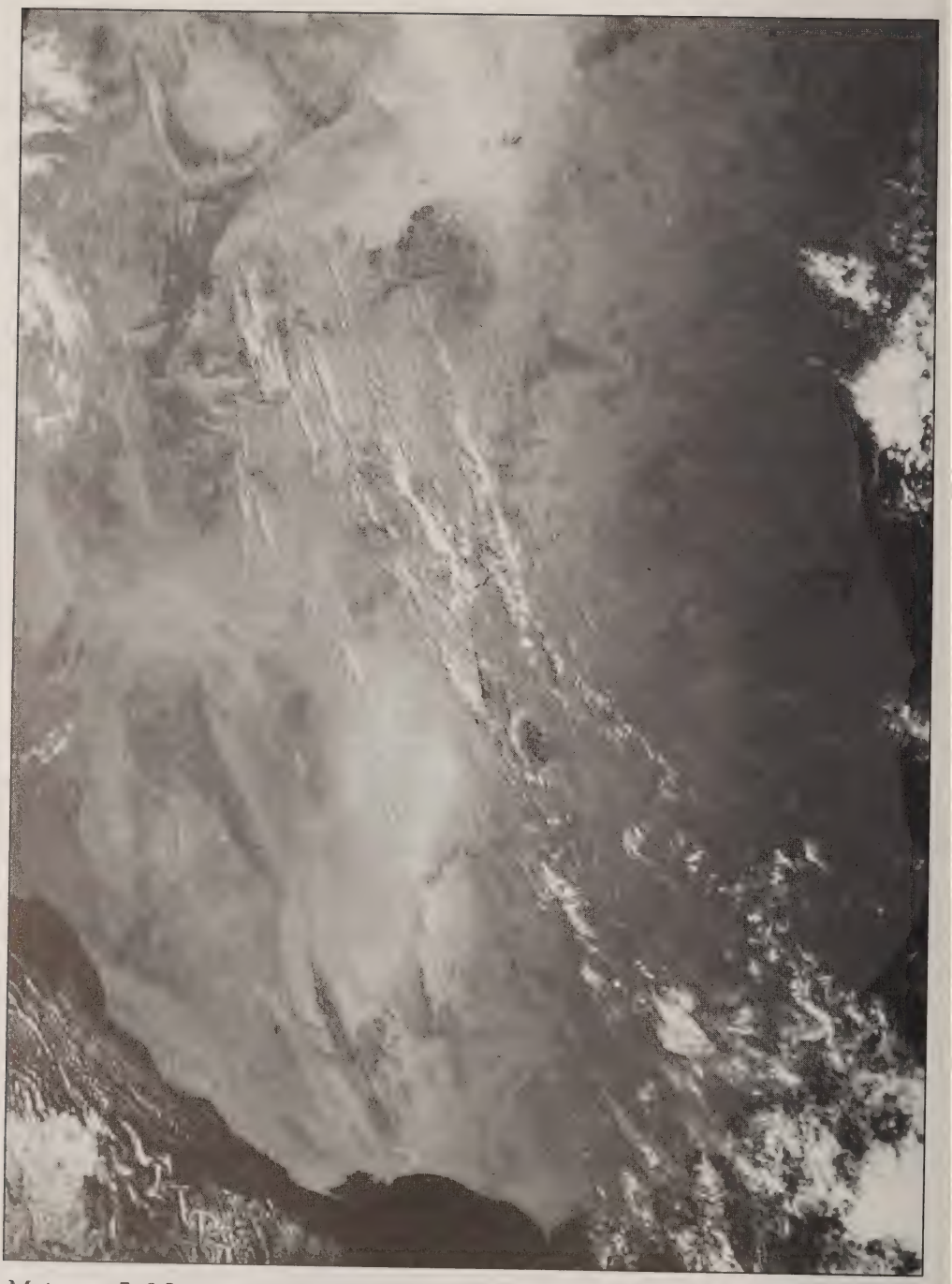
We hope members noted that the AGM had moved from the usual venue at Sandown Park to a later than usual date at Guildford. Sincere apologies to those who went to Sandown on 19 February expecting to see us. We did not attend this rally this year.

SUBMISSION OF ITEMS FOR PUBLICATION AND COPY DEADLINES

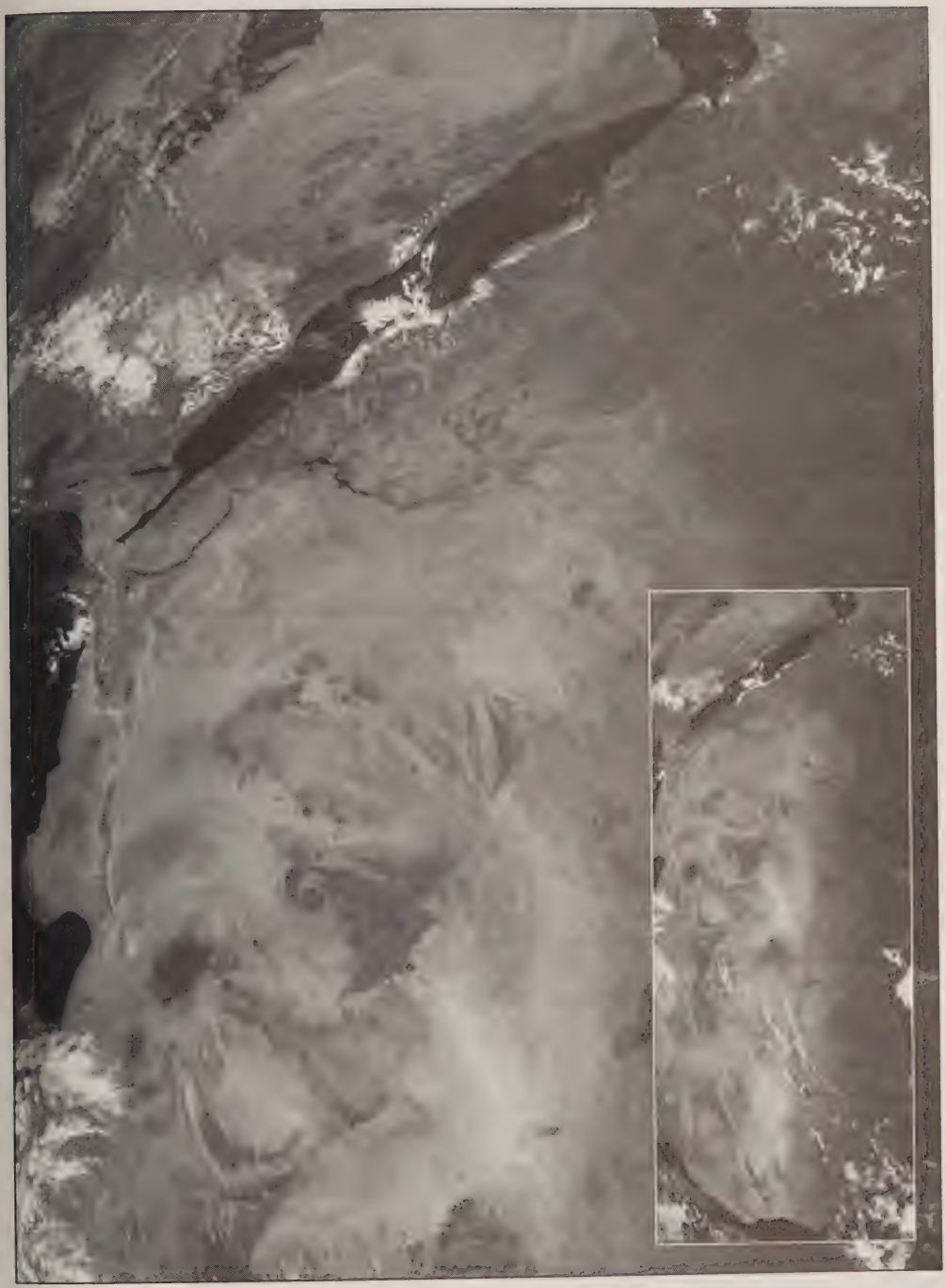
Please send contributions to the Editor. Although typed and hand-written items are quite acceptable we would prefer longer pieces to be on a PC disk in one of the popular word-processing formats, ideally in Word Perfect. Drawings and diagrams may be submitted on disk, preferably in a Windows Meta File compatible format, but please send hard copy also. To reproduce well, satellite images must have a good range of tones. Contact the Editor for further information.

COPY DEADLINE FOR THE JUNE ISSUE: 25 APRIL 1995

Advertisers' copy is required by 18 APRIL 1995 and should be sent direct to Michael Gill (address on page 2).



Meteosat 5, 8 January 1995 1130UT. NW Africa. Image by Peter Wakelin.



The eastward continuation of the image on page 76.

SO YOU HAVE YOUR DISH! HOW ARE YOU GOING TO MOUNT IT?

Just contact us and state your requirement.

Mounting steelwork for any size of parabolic or pyramidal horn antennae:

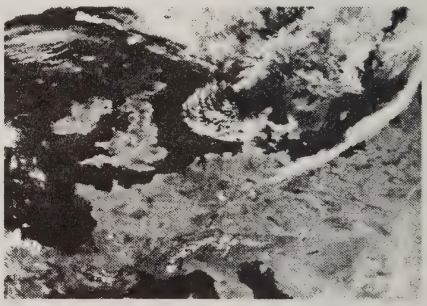
Sensible prices: Special discount for RIG members:

GUNDERSEN ENTERPRISES LIMITED

16 St John's Place, Rhoose, Barry, South Glamorgan, CF62 3EB. Tel/ AutoFAX 01446 710459

TH2 Imaging

34 Princes Gardens
Margate
Kent CT9 3AR
Tel : 0843 - 223831
Fax : 0843 - 862212



TH2SAT PC Weather Satellite Processing System Version 2.2

- Instantaneous control of input levels from keyboard while receiving
- Input levels automatically saved
- Large range of *simple to operate* image processing commands
- Very simple image pseudo-colouring facilities (including infra red)
- High definition images obtained due to high 4800 hertz sampling rate
- Colour animation included as standard
- Fully working demonstration program available for £3.50

Price £100 + postage (RIG members)

APT Hardware & Software

JVFAX Interface For those hundreds of you out there who have sampled the excellent JVFAX 7.0 software from Eberhard Beckashof, we offer this superb interface to do it justice. The JVF1 supports APT/WEFAX and FAX modes and features a dual microprocessor design, with separate inputs and individually optimized filter sections.

Interface and cables now available at special prices from the RIG Shop

Amigasat 3.2 The Amigasat package, like the Amiga, continues to go from strength to strength, with this new version fully supporting Commodore's 256 colour AGA graphics. Remember, if you've got an earlier version you can always upgrade to the latest for a modest sum. Amigasat remains the only package to *reliably* decode the digital headers from Meteosat for truly automatic reception. For a more comprehensive description of version 3.1 see our ad. on p74 of RIG36. **£139.95 + £4 p&p**

MSC30 Downconverter Our policy of continuous development ensures that the MSC30 Downconverter remains the finest you can own: Features include very low noise figure, high gain, buffered output for driving long cables, and good temperature stability. In addition, the MSC30 can be powered either by conventional 3-wire system or via the coax feed. High quality N-type input, BNC output, and housed in an IP65 sealed diecast enclosure. Comes complete with N-type/N-type cable, connectors etc. **£170 + £4 p&p**

MSD30 Dish A 95cm prime focus dish, of spun aluminium. Complete with MSF30 feed & heavy-duty ground stand. Gain - 22dB **£149.50 + £18 carr. & ins.**

MSF30 Feed Our popular 1.7GHz dipole feed for Meteosat, GOES, and GMS **£44 + £3 p&p**

MSQ20 Quadrafilar VHF Antenna. Very compact - ideal for boats and sensitive sites **£48 + £5 p&p**

with integral preamp **£64 + £5 p&p**

MSA20 Turnstile VHF Antenna. Comes with 20m cable and BNC terminated **£36.50 + £5 p&p**

MSL30 1.7GHz LNA Professional-quality low noise amplifier using HEMT GaAsFET first stage, and housed in sealed diecast housing. Has N-type input and output connectors, and power is provided via the output feed. N_f = 0.7dB, A_V = 28dB min. (other gains to order) **£134 + £4 p&p**

MSK30 137MHz Preamp A new design, offering low noise and wide dynamic range. The gain can be set by adjusting the supply voltage via the feed cable from 4v - 12v, to give A_V = 5dB - 22dB. Nf=1dB **£18 + £2 p&p**

Ordering Information

U.K. and E.U. customers add 17.5% VAT to above prices.
Overseas customers will be charged carriage at cost.
Payment may be made by cheque, postal order, or Visa, Access, and Mastercharge Cards.

martelec *communication systems*

The Acorns, Wyck Lane, East Worldham, Alton, Hants GU34 3AW, U.K. Tel / Fax 0420 82752

Why PROsat II ?

NOAA Temperature Calibration

NOAA Latitude Longitude Gridding

NOAA Country Outlines

Distance and bearing from any two points

Controller available to auto-schedule passes and to set the receiver frequency in your absence

All satellites catered for, no exceptions

Windows export in full resolution

Up to 600DPI printer support

Track II	**THE Definitive tracking program that shows up to 6 satellites on screen simultaneously**
Colour Animate	**Up to 1,000 frames in full colour with real-time pan and zoom**

Professional software, not public domain

Now, for the first time, you get PROsat II and all it's software, Track II AND Colour Animate for just £99.00 ! plus £6.00 carriage and VAT

Timestep PO Box 2001 Newmarket CB8 8XB England
Tel. 01440 820040 Fax. 01440 820281

Timestep Offer to RIG Members
PROsat II Capture Card

PROsat II has become the most widely respected and definitive Weather Satellite Capture program used by RIG members. It will operate in most contemporary PC's (286, 386, 486 etc with SVGA) and uses one internal slot. All software features are selected with user-friendly mouse-operated pull-down menus. False colour can be added to good quality visible light images. Capable of receiving and decoding all known analogue weather satellites, PROsat II sets new standards in Software and Hardware design. Image processing, full colour animation and 3D are just some of the many features currently included. New features are constantly being added. Now technical support is directly from Timestep. Timestep Weather satellite systems are used and recommended by Arthur C. Clarke, author of "2001 : A Space Odyssey" and inventor of the communications satellite.

Other software comes and goes, sometime the flavour of the month, sometimes forgotten.
PROsat II just gets better and better ! When the new Okean 4 was switched on, it came as no surprise that PROsat II users merely clicked on OKEAN and achieved perfect results, first time.

Geostationary Satellites Meteosat, GOES and GMS are all geostationary satellites; they orbit at the same rate as the Earth and hence appear to be fixed in the sky. Images are therefore constantly available. The PROsat II system covers all known analogue geostationary satellites; images of the Earth's surface can be received as often as every 4 minutes. A small dish antenna is required together with some simple reliable hardware.

Polar Orbiting Satellites NOAA, Meteor, Okean and Feng Yun are polar orbiting satellites. They pass near to the poles about every 110 minutes. Each satellite passes over most countries twice a day at a different time each day. Their strength is such that a simple fixed antenna can be used. Direct readout of temperature along with latitude and longitude is an important feature of the software. Now land/sea and political boundaries can be superimposed on to the image and "nudged" if they are not quite perfectly aligned. All of the satellite data is stored; a full view of Infrared and Visible images are shown on the screen during reception.

Colour Animation Full screen, full colour animation is now standard. Up to 1,000 images can be automatically animated. The colour is realistic and computer processed (D2 section only) and even shows relative temperature by the shades of blue for the sea and green for the land. Clouds show up as white and shades of grey. Reception is completely automatic. Run the software and walk away; every time you pass, the computer will be showing the very latest sequence.

Geostationary Features
Images as often as every 4 minutes
Live display of incoming images in 64 grey scales
Auto schedule to save images
Pan and zoom to greater than pixel level
3D display
Median filter to remove country outlines
False colour with AutoSet
1,000 frame colour animation (option)
Transect between any two points
600 DPI, 300 DPI and dot matrix printing
Windows export
Annotation

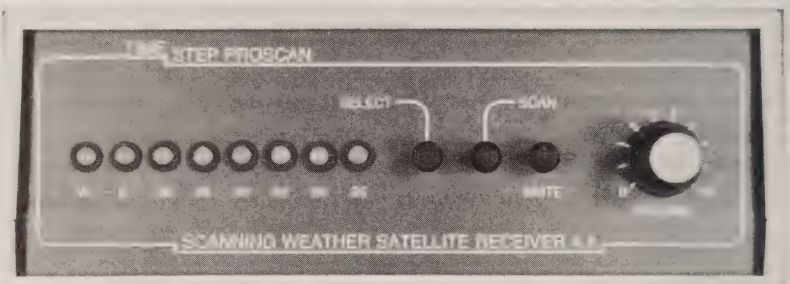
Polar Features
Reception of all polar satellites
Live display of incoming image in 64 grey
Auto schedule to save images scales
Saves the complete pass in full resolution
Temperature readout with no calibration
Latitude and Longitude gridding
Country and State outlining
Distance and Bearing between any two points
Your location shown on image
600 DPI, 300 DPI and dot matrix printing
Windows export
Annotation

Track II The tracking program used by most serious satellite watchers. This is not public domain and was written by Peter Arnold our Cambridge Graduate. Up to 6 satellites can be shown on screen all at the same time. Actual locations, their footprints and their rise and fall times are always shown. To our knowledge, no other program provides these features.

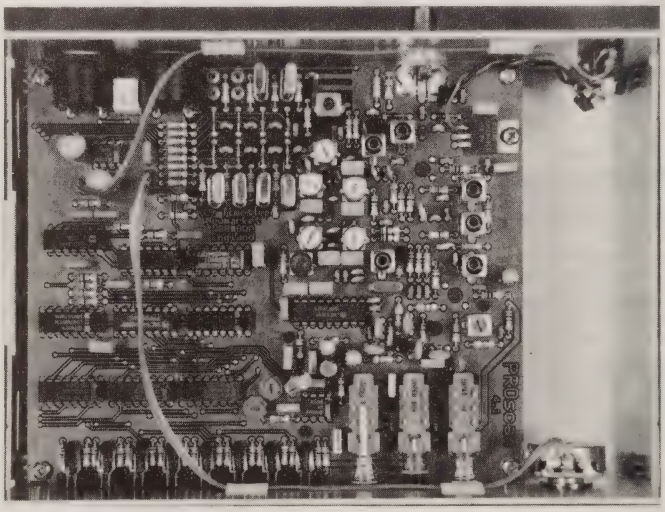
PROsat II card/software including Colour Animate & Track II £99.00
PROsat/PROscan connecting cable £12.00 All prices plus £6.00 carriage & VAT at 17.5%

Timestep PO Box 2001 Newmarket CB8 8XB England
Tel. 01440 820040 Fax. 01440 820281

Timestep Offer to RIG Members
PROscan Polar Receiver



What do you want from a Scanning Weather Satellite Receiver ? a) Intelligent squelch that only responds to weather satellites and is quiet when no satellite is present b) To be able to read the frequency directly from the front panel when it stops on a satellite c) To be able to "lock out" unwanted satellites d) Resistant to pager interference up to the pager transmitter itself (where of course the field strength is low e) Resistant to pager interference at 1 to 2 miles where the field strength is at a maximum f) An unconditional 12 month money back guarantee g) Full technical support directly from Timestep **and** h) the ability to control the receiver frequency from the computer so that you are sure that **all** passes can be received in your absence.



The PROscan receiver uses a lot of filtering, 3 coils in the pre-amp (optional), 4 coils in the RF amp (total 7 coils at RF), 3 coils in the oscillator, 1 matching coil at first IF, 5 ceramic filters at first IF, 5 coils at second IF (total 11 IF filters) and a quadrature discriminator for linearity and high ultimate signal to noise. A preamplifier is not required for short cable runs but adds extra selectivity and makes up for feeder loss on longer runs.
PROscan receiver £185.00 VHF Preamp in diecast box £20.00 **Computer controller** £125.00
UK postage £6.00 plus VAT at 17.5%

Timestep PO Box 2001 Newmarket CB8 8XB England
Tel. 0440 820040 Fax. 0440 820281

New Member ?

New to RIG ?

Want to receive Weather Satellites 24 hours a day every 4 minutes from the Geostationary Meteosat ?

Confused about Computers ?

Hesitant about Hardware ?

Stupefied about Software ?

Unsure what the above two headings mean ?

Still want images every 4 minutes ?

Want a 5 year Guarantee ?

Want the best from a BS5750/ISO9002 approved supplier ?

Want a system approved by Arthur C Clarke ?

OK, so you are now a RIG member:
A complete Meteosat PROsat II Weather Satellite System,
The Dish, The Preamplifier, The Cable, The Receiver,
The other connecting cable, The PC Interface Card,
The Software, Colour Animate, Track II, The manuals,
The Technical Support, The Five Year Guarantee.

THE BUSINESS £750.00
no tricks, no add ons no extras.

This price is valid until March 1996 includes colour animate and TRACK II.

Plus VAT at 17.5% and carriage at £6.00 in Britain.
Visa and MasterCard credit cards taken.

Timestep PO Box 2001 Newmarket CB8 8XB
Tel. 01440 820040 Fax. 01440 820281

Trade Talk

** Spring news to **RIG Members** from Timestep **

PROsat II Competition is rife in the industry. As they say, our loss is your gain. We are sure RIG members are driving prices right down, and why not ? Well, we at Timestep always have a few aces up our sleeves ! To our knowledge no-one has produced a better weather satellite tracking program than TRACK II. To our knowledge no-one has produced an animation program that is as fast, has as many colours, has smooth flicker free animation, has real time dynamic pan and zoom and works properly. OK, in the past these two programs would have cost you an arm and a leg, but worth it ! Now we are bundling these for free ! Spring madness ? don't wait to find out !

PROscan The new PROscan receiver controller is in stock. Simply connect it to the computer printer port and the PROscan receiver, run the new software supplied and sit back. You can schedule multiple passes of different satellites on different frequencies for perfect reception in your absence.

PDUS OK, you may know the good news and the bad news. The bad news is that with the antenna problem on Meteosat 5 and the addition of an extra MDD channel, the signal strength has gone down, you now need a bigger dish. The good news is that once you have bought the Key (from the Met Office/Eumetsat) and the Key Interface from us at just £150.00, you will get free access to whole earth images every 30 minutes and 2.5KM European images also every 30 minutes. Expensive; but like having NOAA every 30 minutes only twice as good !

HRPT Following intensive development we now have a helical feed that works as well, if not better, than the dual feed and combiners AND it's £100.00 less to use ! It's lighter and doesn't need such elaborate metalwork to hold the dish to the rotator, hence the dish price is down too ! And it's available without the ground stand that you can get cheaper from your local TV satellite supplier. The tracking controller comes with a modified version of Track II and works perfectly with all but directly overhead passes, giving you time to have a cup of coffee, read the paper, AND get the best images you can have.... at any price.

1.1Km resolution, 5 spectral bands, 10 bit data, 80Mb data files, false colour, multi-spectral colour from any 3 bands (requires multi-spectral view II) and the greatest fun and resolution your are ever going to get (well for 10 years at least).

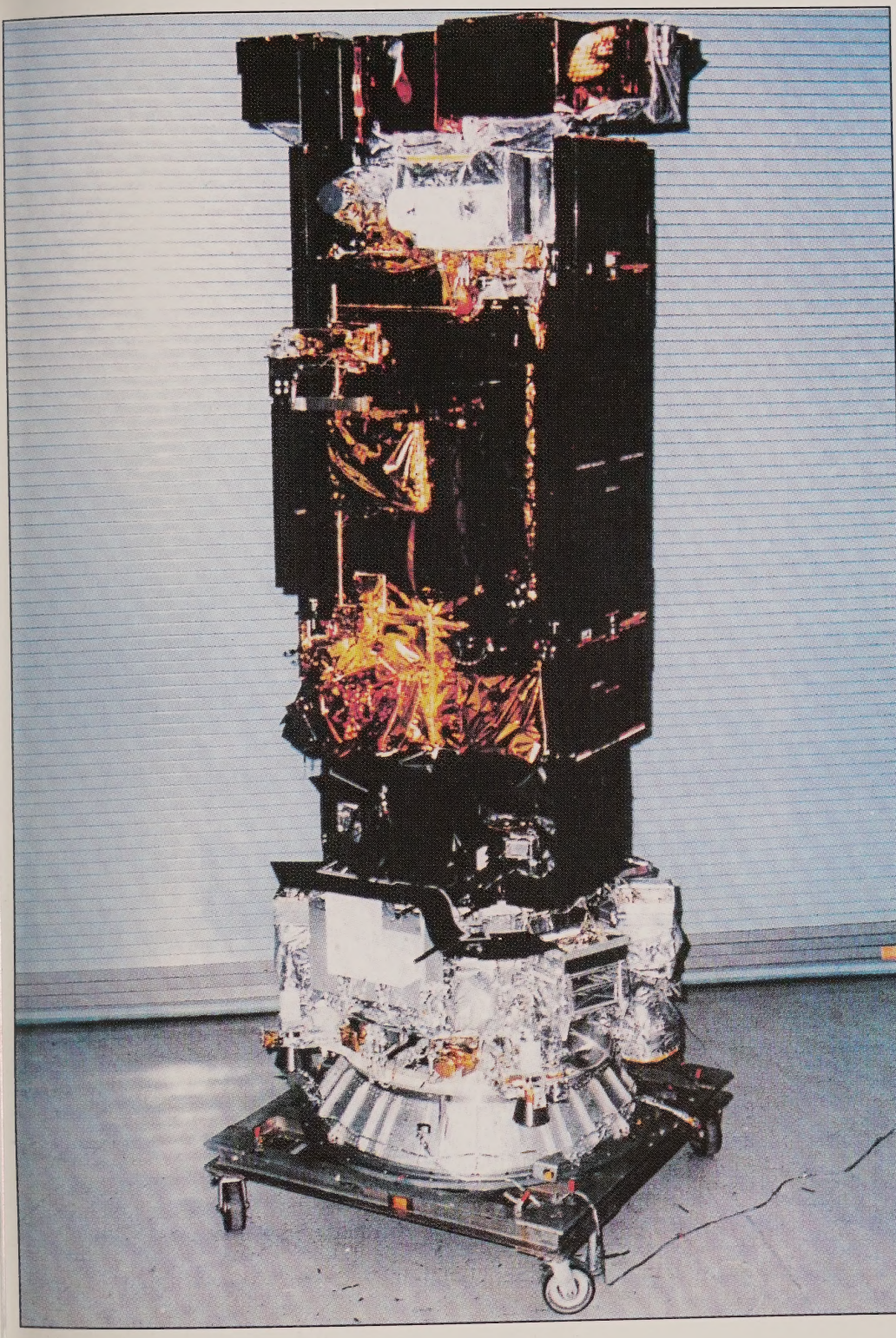
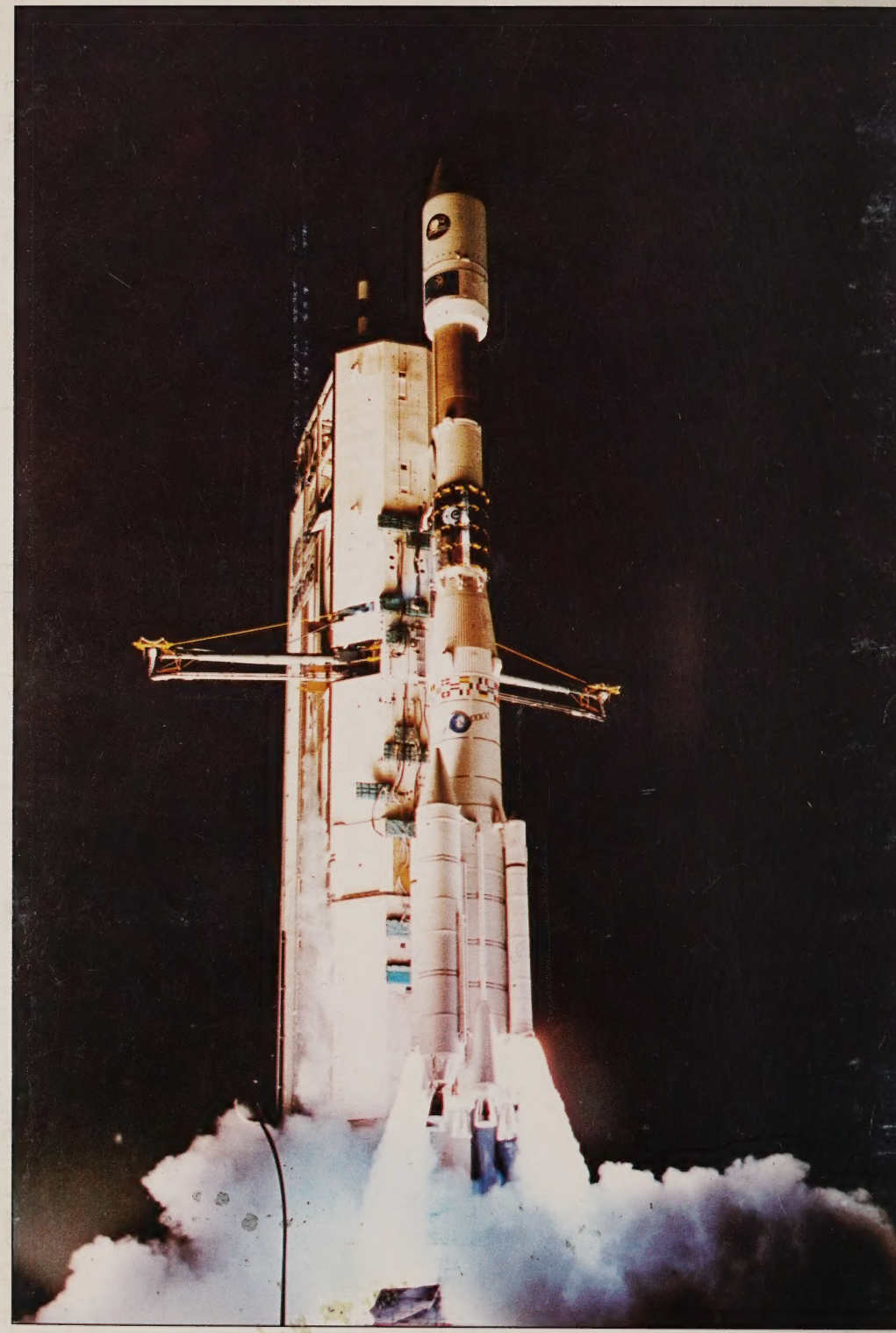
These RIG prices for HRPT really are silly, we WILL hold them for a little while yet though.

Rallies Neither RIG nor Timestep are going to as many rallies this year. If you want to see everything, HRPT 1.1KM stuff, PDUS and buy at RIG Member prices, make sure Timestep is going to be there. Unfortunately the RIG AGM and one day conference clashes with Dayton, the World's biggest rally, therefore Timestep will not be attending. IF you want to see EVERYTHING come to Pickets Lock in North London on Saturday 11 March and Sunday 12 March. RIG will be upstairs in the usual Club Spot, and Timestep demonstrating PROsat-PROscan-HRPT-PDUS and Multispectral View II will be in the main Red Hall with Yeasu, Kenwood and Icom. This along with Leicester really are the only two places that all the major exhibitors attend.

Pentiums How many Pentiums does it take to change a light bulb ? 3, one to screw in the bulb and one to steady the chair.

NOAA HRPT new RIG prices

90cm dish, helical feed and all metal work to fit Yeasu rotator	£150.00	RHRPTDISH
Yaesu R5400 Az-El rotator	£400.00	RYEASU540
20M control cables and heavy duty connectors pre-fitted must be ordered at the same time as the Az-El rotator	£ 80.00	RHRPTCABL
Tracking unit and software for automatic operation (needs separate computer)	£150.00	RHRPTAUTO
P-HEMT Preamplifier (at this price only with HRPT RX)	£100.00	RPPHEMP
20M signal cable	£ 15.00	RP20M
6 channel (5 fitted) HRPT receiver	£400.00	RHRPTRX
HRPT PC/AT card and full software	£150.00	RHRPTCARD
Complete system as above	**£1,445.00**	RHRPTCOM
Extra 20M signal cable and line amplifier	£ 50.00	RLINE
Helical feed for using your own dish	£ 45.00	RHRPTHEL

All prices plus VAT at 17.5% and carriage at £6.00 in Britain. Visa and MasterCard credit cards taken on orders over £25.00.

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